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## CONTENTS.

An Asterisk (*) denotes an illustrated article.


EDITORIALS—

Briefly Told ..... 885
The Public Lighting Problem in New York City—Annual Meeting, Laclede Gas Light Company—An Interesting Chapter in the Revolt of the London Gas Stokers.

The Market for Gas Securities ..... 886

How to Increase the Revenues of Municipalities by Taxing Gas Companies ..... 887

Remarks on the Methven Paper on Photometry ..... 889

The Utility of Water in Gas Manufacture, by Thos. Newbigging ..... 891

Electric Welding ..... 891

Station Meters ..... 892

*Suspension for Arc Lamps ..... 893

A New Method of Constructing Scaffolding ..... 894

Influence of the Percentage of Ash in Coal on the Yield of Coke ..... 894

ITEMS OF INTEREST FROM VARIOUS LOCALITIES ..... 895
Improvements at Duluth, Minn.—Public Lighting, New Haven, Conn.—The Hargis & Eastin Claim Against the Louisville Gas Company—No Consolidation at Bloomington, Ills.—A Busy Firm—A Lawsuit—Cheaper Gas for Newport, R. I.—New Gas Company—The Vice-Chancellor of New Jersey Decides Against the Elizabeth Gas Company—Cheaper Gas for Holyoke, Mass.—Beating a Gas Meter—Recovered Damages—Increase in Sendout, Lewiston, Me.—Bids for Gas Coal Supply—Death of Jno. C. Hunter—Cheaper Gas for Ironton, O.—And Many Other Items.

Spiral Weld Steel Tubing ..... 897

Water Power for Electric Lighting ..... 897

Condensation in steam Cylinders ..... 898

The Velocity of the Wind at the Top of the Eiffel Tower ..... 898


## BRIEFLY TOLD.

THE PUBLIC LIGHTING PROBLEM IN NEW YORK CITY.—The axe of the Department of Public Works is heard in the city, and its "thud" is accompanied by the crashing of poles, the crinkling of wires, and the rumble of the Department wagons. Of course all this might be accepted with equanimity by the residents of and the visitors to the metropolis, were it not for the fact that the aforesaid *melange* entails to a great degree the plunging of a large portion of the city into comparative darkness, and at a time—just prior to the Christmas season—when the streets are most availed of during the earlier hours of the night. To add to the confusion and distress, the atmospheric conditions prevalent are those that render a plenty of artificial illumination an absolute necessity to one's safe guidance through the streets. London fogs, Atlantic seacoast snow and rains, New York mud, and so on, are with us in an all too great profusion. And why is this confusion, and how long is it to last? The answer to the first proposition comes readily enough. When the electrical companies were chartered some years ago, the construction methods followed by their proprietors were possibly of the best type known at the time, and in that day no doubt were ample. According to the conditions under which their business has since been carried on—a hurried rush to secure what customers they could, and to retain the same as long as they could—the method of construction, more particularly in respect to the division of distribution, did not keep pace with the day and the development. Faultily wrapped wires, or wires about which no attempt at insulation was made, in process of time became dangerous, and finally human life was sacrificed, when the sacrifice would not have been recorded had the electricians paid due heed to the methods of construction that would have rendered their wires safe. It is ridiculous to pretend that the companies were not given ample time in which to bury their wires, for when the compulsory bill against overhead wires was passed, the measure permitted an allowance of many months wherein at least an *attempt* to put the offensive strings underground could be offered as evidence that the mandate of the Legislature would be obeyed. It is also needless to say that no method of a fairly satisfactory system of underground wire placing has been evolved. Such conduits are in fair working order in other cities of the country, and Edison in this city has shown that underground electrical distribution can be successfully carried out, in the case of currents for incandescent lighting, on a large commercial scale. The secret of the failure—if any secret it is—of the arc companies to make any attempt at compliance with the law is undoubtedly to be found in the item of increased expense. Even with a ramshackle overhead system of conveyance the companies encountered great difficulty in making any dividend return to their shareholders, and such being the case, with a much more expensive system of distribution the chances for the stockholders would be brought much nearer to the vanishing point. Apart from any such considerations, however, the wail that is now being raised by the proprietors of the companies over what they are pleased to term the wilful destruction of their property by the authorities of New York, we are inclined to thnk will not save them from being called on subsequently to answer in a more pointed way for their sins of omission. Contracts of a public nature are not as a rule one-sided. These companies have agreed to maintain a public lighting service in all respects consonant to the regulations imposed by the authorities. Has this lighting service been carried out? The answer is plain. Not only has it been faultily performed, but its poverty was such that the authorities, in pursuance of their police function as the protectors of human life and private property, have been obliged to level to the ground appurtenances that, instead of acting the primal part of furnishing a means of public assistance, have become agents for death and disaster. That we do not overdraw the picture is shown in the following language from the decision of the General Term of the Supreme Court, in dissolving the injunction obtained by the companies restraining the Public Works and the Board of Electrical Control from interfering with their wires. The judges say: "* * * but in his proposition the counsel for the plaintiffs overlook the important fact that it is because of the negligence of the plaintiffs that these wires were allowed to become a public nuisance. The plaintiffs have become guilty of a wilful violation of a manifest duty in allowing these wires to become dangerous. They are without excuse, and when they claim that the destruction of these instruments of death, maintained by them in violation of every duty which they owe to the public, is an invasion of their rights of property, such claim seems to proceed upon the assumption that nothing has a right to exist except themselves. It is idle to say that a party maintaining a nuisance which may at any time deal death to innocent passers-by can for an instant be entitled to the protection of the law in its maintenance. If these plaintiffs had been without fault a different question would have been presented; but it is evident they are guilty of

the highest degree of negligence." This is rather outspoken language, but is in all respects applicable.

In regard to our second inquiry (how long is this confusion to last?) we can but say that it is terminable at the will of the authorities, who, when they choose to see it, have at their disposal a means of lighting the city that is in no whit inferior to arc lighting either in efficiency or economy, and which in point of reliability far surpasses the arc system. Improved high-candle power street burners are on the market, and who knows but their adoption shall lead the Metropolis out of its present darkness?

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ANNUAL MEETING, LACLEDE GAS LIGHT COMPANY.—At the annual meeting of the Laclede Company, at which about 75 per cent. of the stock was voted on, Messrs. Emerson McMillin. J. C. Van Blarcom, J. D. Thompson, W. W. Gibbs, H. B. Hollins, John R. Lionberger were elected a Board of Directors. This composition shows that the old Gas Trust of St. Louis will remain an important factor in the gas business of the city. There is no reason to doubt that Mr. McMillin will be re-elected President, and that Mr. Thompson will be named to the Vice-Presidency.

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THE bill to permit the Charleston (S. C.) Gas Light Company to readjust its capital stock has been unfavorably reported upon.

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THE proprietors of the Asbury Park (N. J.) Gas Company have reduced the selling rate to $2 per 1,000 cubic feet.

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AN INTERESTING CHAPTER IN THE REVOLT OF THE LONDON GAS STOKERS.—Despite the great concessions made to the stokers in the employ of the London gas companies "independent labor" refused to be quieted by them. As usual, however, the independent laborer again overshot the mark, and his arrogance led him on to defeat. A very clear and interesting exposition of the muddle and how it was cleared up by at least one London gas man (Mr. Livesey) was printed in the special correspondence of the New York *Tribune* (15th inst.), the article in question being as follows:

"LONDON, Dec. 14.—The revolt of the English laborer against the existing relations between society and himself spreads fast, but runs an uneven course. Down to this week the strikers have been winning; but this week, with one conspicuous exception, their history is one of disaster. The Silvertown strike and the far more important Manchester gas workers' strike ended in complete collapse. The men were beaten at Silvertown because they were met with courage and determination equal to their own, and with resources and organization far superior. The facts in that case have been stated, and need not be repeated. So of Manchester. But what is remarkable in Manchester is that the victory has been won by the community itself over one section or one class. Municipal Democracy has shown itself able to govern, when occasion arises, with a strong hand. Manchester people soon made up their mind that they did not care to see taxes raised in order to increase the wages of the gas stokers, which were already high. They preferred governing themselves to being governed by the Gas Stokers' Union. They used the police from the beginning to keep order; and when police are used to keep order strikes of the present type have little chance, for the chief weapon of these unions is intimidation, supported by violence.

"Little attention, however, is paid in London to what is happening in the provinces, for London has one huge strike of its own on hand, and has had a narrow escape from another. The strike of the gas stokers employed by the South Metropolitan Gas Company, threatened last week, was finally completed on Friday morning. The question at issue, which I described in detail last week, may be summarized in a sentence. It was strictly analagous to the question at Manchester. What the Directors of the South Metropolitan had to decide was whether they preferred to manage their own Company or to have it managed for them by the Gas Stokers' Union. They never hesitated for a moment. They have a chairman, Mr. Livesey, who knows his business and his own mind. He is the Company. He told the strikers from the start that there could be no compromise on this one vital point. He has been as good as his word, and, in the present semi-demoralization of English public opinion, he is a public benefactor. The number of men in this country with backbones has been sadly reduced since the widening of the suffrage. Mr. Livesey has kept his. I imagine that he welcomed this contest, for the men went out of their way to put themselves entirely in the wrong.

"The hand of the outsider in this, as in most other strikes, has been heaviest. It is the officials of the Gas Stokers' Union who call out the men. The sole pretext for their act was their well-founded belief that the bonus system offered by the Company, while admittedly generous to the men, relaxed the tyranny of the trades unions over men and employers alike. Probably no strike could be successfully carried out if that system were once established. Strikes are not now attempted except upon notice. If the men are engaged by the week, they give a week's notice of their intention to leave; if by the month, a month's notice. To give a year's notice would reduce strikes to an absurdity; nor would all the notices run from the same date, so that concerted action of the men at the command of the unionist officials would become either impossible or illegal. Hence this struggle. It is a struggle by a trades-union for power over other men's affairs. There is no complaint of wages or hours. There has been no refusal by the company of any reasonable demand by the men, or, indeed, of any demand whatever. No unredressed grievance, no hardship appeals to the public sympathy. Therefore it is that no public sympathy is shown with these strikers.

"Public opinion rapidly growing soft on these questions has hardened a little. Londoners have looked on the proceedings south of the Thames as on operations of war. They have seen Mr. Livesey victual and garrison his fortress, not without admiration of his soldierlike qualities. Their natural disposition would be to regard any gas company as an enemy of mankind, but even the general dislike of these corporations does not deprive them of approval and support in this emergency. Public opinion has, in fact, compelled a reluctant Home Secretary to marshal his police force on the side of public order. The possibility that all of South London might be left in darkness did not please South London or North London, either. There were fears also of injury to the works, of a conflagration and an explosion of gas. The stokers were reported to be in a desperate temper, and on the whole the police thought it best to do their duty, and they did it admirably.

"The different works of the South London Company and the approaches to them were occupied early in the week in such force that the strikers saw it was hopeless to attempt violence. Thursday and Friday were critical days. Most of the strikers were paid off and left on Thursday, the last of them at 6 on Friday morning. Two hours later began the delicate business of introducing new men into the different works at Rotherhithe, Greenwich, Vauxhall and old Kent Road, about all of which pickets were stationed in great numbers. Mr. Livesey's well-laid plans worked well. The men arrived in batches at the railway stations from the north, south and west, and the police occupied the stations. Unionist pickets were everywhere, but were never allowed to get near the arriving laborers, whom they meant to coax and intimidate. The police even expelled pickets from the stations, a wholesome example of unwonted energy. The new men were escorted from the railways to the works by bodies of police, mounted and on foot. The crowds surged about them, and sometimes snatched at a man or two, but not half-a-dozen were detached altogether. Before noon all of the Company's stations were once more fully manned and at work.

"So complete was the defeat of the strikers that they even withdrew their pickets. They are without skilled leaders, their plans are yet to make, and their battle seems lost before it is begun. They found themselves last night in a fog, which settled densely over the whole district; but the supply of gas held out and the manufacture of it went on, though with difficulty. There are fresh manifestoes this morning. The strikers appeal to the public for funds. Over 2,500 are out, and their union is poor; money they have next to none. The public is sorry for the men, but is not this time disposed to find capital for carrying on a war against itself. Mr. Livesey shows himself clement in victory. He tells the men that if they had made Thursday's proposal in time it might have been accepted, for it yields all that they had refused even to consider when he himself made it. Now he is bound to the new men who have come in, but still, as vacancies occur, the old men may return if they like."

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## The Market for Gas Securities.

The market for city gas shares was strong on large dealings during the week, the upward tendency being more pronounced as the week drew to a close. To-day (Friday) Consolidated sold up to 94¼, which is an advance of close on to 16 points over the corresponding sales rate of a twelvemonth ago. The business being done by the Company is simply enormous, and there is every probability that the increase will be steadily maintained. We have no hesitation in advising purchase of this stock at anything under par. Equitable is at 124, which also represents a sound gain in value over the estimate of a year ago, when the shares were at 118. Chicago Trusts are stronger, the opening quotation to day being 43⅛. These shares are undoubtedly a purchase. Brooklyn shares appreciate steadily in value, although we are inclined to the view that the top notch in most of them has been reached. The White Plains Company (Westchester, N. Y.) will likely make a new issue of stock. The general situation is favorable.

## How to Increase the Revenues of Municipalities by Taxing Gas Companies.

On the evening of the 10th inst. Mr. C. M. Armstrong, a member of the Baltimore bar, delivered an address before the Landlords' Mutual Protective Association, of Baltimore, in respect to the merits of the proposition recently made by him to the effect that the General Assembly be requested to further regulate the supply and sale of gas in that city. In short, the proposition of Mr. Armstrong is to cause the city to become a partner in the Gas Company, the former guaranteeing a monopoly of the gas supply to the latter, in consideration of a specified method of each sharing in the profits. Premising our abstract of the Armstrong address with the remark that we are indebted to Mr. Jas. B. Smallwood, of Baltimore, for a copy of the same, we herewith place its salient points before our readers.

There are several interesting questions I would like to talk to you about to-night. The importance of making Baltimore a manufacturing center, and how, by the proper legislation, this may be speedily effected without costing the city a dollar, and, on the contrary, bring a steady annual revenue into the public treasury—how not a single steam railroad in this State pays one dollar of State taxes on its property—how the exempted railroads can be made to pay taxes—the electrical companies—overhead and underground wires—and other similar matters. These are all of kindred nature—and the subject of this evening, the general principles stated, will for the most part apply to them, and with the exception of the steam railroads they are all alike proper sources of considerable revenue to the city treasury; railroads should pay their franchise tax to the State treasury. But I find that I can only do justice to one subject, and shall confine myself to that—*i. e.*, the relation of the gas supply to the city treasury, or one way to provide for the increased municipal expenses.

There are three elements that must be kept in sight in a fair discussion of this subject:

1. The interest of the people as a whole (the municipality).
2. The interest of the people as individuals (the consumers and the taxpayers).
3. Justice to the Gas Company.

1st. *The Interest of the People as a Whole.*—Public expenses must be provided for. The city's expenditures are not large, and, as I have already stated, they are growing. It is not desirable to inaugurate such a system of economy as will deprive us of the benefit of any of the improved conditions of modern city life. Rather we should reach out after all these, and make for our people every known public provision which can contribute to their health, comfort, prosperity, and general advancement If we fail to do these things the fate of our city is sealed. If we do them there lies before us an era of splendor, wealth, and power, such as the most enthusiastic among us scarcely dare to dream. I would like to show you how proper requirements exacted by public authority and the exercise of appropriate municipal control will develop in our midst that which will be now our greatest boon—manufacture—the indispensable handmaid of a permanently prosperous city. But I have not time this evening. It suffices at present to say that it is necessary for the city to spend large sums of money in order to perform its duty to the people.

How will it get this money? That "new and largely productive source of revenue" which lies nearest to "your door" and closest to "your hand" is a share in the profits of the Consolidated Gas Company. The fairness of taking a share of these profits I will discuss under the third head. Just now I am talking about the financial advantages to the city treasury. The entire business of the Gas Company is in its very nature a public possession—it is a public right or franchise. The Company only engages in it by virtue of a public grant or license in the form of the franchise conferred by its charter. Now, let the public take its proper share of the profits of this public business, allowing the Company as its share of profits a fair dividend on its capital stock. A proper division will be as follows: After the payment of expenses of manufacture and interest on the existing debt, allow the Company to take out of the profits annually, first, a 6 per cent. dividend for its stockholders, and, second, a sum equal to 1 per cent. on the capital stock, which shall go into the sinking fund to pay off the present debt of the Company, the right to the 1 per cent. to cease as soon as the sinking fund is full; and let the entire residue of the profits go into the city treasury.

There are several points in this plan that must be properly guarded. Heretofore in the history of American cities, whenever a corporation has been required to pay into the public treasury a share of the net profits from its business, the directors have always managed to make so large an expense account that the books showed little or no profits to be divided with the city. And by some means, which we need not stop just now to inquire into, a large part of the sums charged to expenses ultimately found its way into the pockets of the stockholders, or perhaps of the directors. Hence it has come to be almost a maxim that a tax on receipts should be always laid on gross receipts, and never on net receipts; but happily we can, in the case of a gas company, protect ourselves against any such hocus-pocus of the expense account. Gas costs the Consolidated Gas Company not more than 90 cents per 1,000 feet, including the interest on the Company's bonds. The interest is equal to about 30 cents per 1,000 feet. In discussing this point I shall treat interest as a separate item, and not as a part of the cost of manufacture. This leaves the actual cost of manufacture at about 60 cents per 1,000 feet. This estimate is not only fair, it is liberal to the Company.

Let the books, papers and business of the Company be open at all times to the city finance commissioners, and give the commissioners power to summon and examine witnesses. At the end of each year let the expense of manufacturing gas for that year be ascertained. If it is less than 60 cents per 1,000 feet let the total sum of expenses be allowed. If it appears to be more than 60 cents per 1,000 feet, then allow the Company to retain out of the gross receipts for the year 60 cents for every 1,000 feet of gas supplied to customers in that year. In addition to the total sum allowed for expenses, allow the Company out of the gross receipts the sum actually payable and paid during the year for interest on its bonds. This plan will make it impossible to tamper seriously with the expense account, even if the Company were disposed to do so.

That which constitutes the advantage—the security of a gross receipt tax—is the fact that such a tax bears a fixed proportional relation to a gross sum, and therefore there is less room for manipulation to the detriment of the city treasury than under an ordinary tax on net receipts.

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The first benefit which the city treasury will derive from the adoption of this plan will be a result of one of its indirect consequences. As a result of the repeated organization of hostile gas companies there has been a series of gas wars, which have exhausted and impoverished the present Company. As a consequence of this state of things, gas stock is so reduced in value that it is valued by the State Tax Commissioner at less than $40 per share. For convenience of calculation we will call it 40. The Company's property is valued at $3,615,141, from which is deducted its plant exemption of $602,780, leaving $3,012,423 subject to taxation. This is deducted from the total valuation of stock, leaving the net valuation on which taxes are paid about $8.63 per share. This yields to the city treasury at $1.90 per 100 about $17,000. The city taxes on the real estate amount to $57,236.03.

Of course, it is plain that whatever amount the valuation of the stock for taxation can be raised is clear gain to city treasury, for the valuation of the Company's property can only be deducted once, and that has been already done. If the conditions which have artificially reduced the value of the stock are removed, so that it can return to its natural value, it will speedily rise to par, and probably higher. This will be effected by the provisions which give the Company the exclusive right to manufacture and sell gas in Baltimore for 25 years, and fix the price at $1.25 per 1,000 feet. Given the whole field and a fixed rate, and the Company's stock will manifestly become one of the best of investments. The difference between the present assessment and par is $60 per share; 103,187 shares are held in Baltimore. The whole of the increased value of the stock will be added to the taxable basis. That is, the taxable basis will at one stroke be increased to the extent of $6,191,220, which, at $1.90 per 100, will yield an annual revenue of $117,633.18. Instead of the direct taxes on the Company's stock and property, yielding a total of about $74,000, as at present, they will yield a total amount of about $191,369.21.

This estimate is, of course, based on the present tax rate of $1.90. If the tax rate is reduced, the revenue will be correspondingly smaller. So much for the benefits to be obtained from the increase of the taxable basis.

Now for the figures as to the city's share of the profits. These she will not begin to realize so promptly, but they will be much greater and will grow constantly larger. This latter is a most important consideration in view of the fact already alluded to that municipal expenses will certainly show a steady and large increase in the future. It is therefore most desirable to provide the public treasury in advance with such resources as will enable it to meet these expenses as they arise, otherwise you will have to pay for them by the increase of direct levies on your property as surely "as death and taxes."

The annual increase in the amount of gas consumed in Baltimore is

about 7½ per cent. Thus the total output of gas about 5 years ago was a little over 850,000,000 feet for the year. It will amount to about 1,200,000,000 feet for the present year. It is a remarkable fact that the amount of gas consumed is steadily increasing in the great cities. I have said this is a remarkable fact, and so it is, for we would naturally expect to see the consumption of gas decrease, or at least that the rate of increase would be smaller, since the introduction of electric lights. But, on the contrary, electricity seems to have stimulated the gas business, and the more light people have the more they want. So the increase in the output of gas goes on at an accelerated rate. See for instance the annual address of President Turner, of the American Gas Light Association, October, 1888, and the annual address of President Norton, of the New England Association of Gas Engineers, February, 1889. The latter says: "Notwithstanding the great number of electric light plants that have been established everywhere, it would be difficult, and I think impossible, to point out a single city or town in which the consumption of gas for lighting is not steadily increasing year by year."

It is fair to conclude from the present economic tendencies in cities generally, our own not excepted, that the percentage of increase will for some years to come be greater than at present.

I will not remind you that New York is not near seven times as large as Baltimore, but she uses nearly seven times as much gas, her annual output being now 7,000,000,000 feet. And so as the population of Baltimore increases the rate of percentage at which the output of gas increases will grow larger.

But I have reckoned the results on the basis of the present rate of increase—7½ per cent. per year and the results are truly astonishing Until after 5 years the city will not receive any share of the profits. From that time it will obtain a substantial and ever-increasing portion each year. These returns are easy to get at. The output of the sixth year (1896) will be 1,851,961,829 feet. The earnings or total receipts at $1.25 per 1,000 feet will be $2,314,951. The cost of manufacture, allowing the maximum rate of 60 cents per 1,000 feet, will be $1,111,176.60, and the interest on the bonds $360,000, making the total of manufacture and interest together $1,471,176.60, which is the utmost that the Company can deduct that year for expenses. This leaves the sum required to be treated in the Company's settlement with the city, as net profits, $843,775. From this deduct $660,000 for the dividend, and $110,000 for the sinking fund, and you have the excess of profits, *i. e.*, $73,775. Then take from this the Company's 10 per cent. bonds, *i. e.*, $7,377.50, and you have for the city treasury a net balance of $66,397.50 in the year 1896. But this is only the beginning. You will probably be surprised to learn that in the ninth year after this beginning the sum going into the city treasury will be over $1,000,000, yet such is the fact.

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Another advantage to the city in this plan is that it will effectually prevent the increase of the Company's stock. The public will be protected against any further watering of the stock. No new company can be chartered for the purpose of forcing the present to take it in. This is a matter of substantial importance, for if the settlement of the gas question is postponed, there will most likely—I might say most certainly—be further contests, consolidations and increase of stock; and then, when the city eventually concludes to face the situation, and undertake, as it inevitably must do some time, to arrive at a solution of the problem, it will be further complicated by the existence of more stock and probably more bonds, and the terms cannot be so favorable to the city.

The longer the settlement of the vexed question is postponed the smaller will be the benefits which the city will be able to secure for herself. So, if this plan is adopted the stock cannot be increased. If betterments are to be made they must be paid for out of the contingent fund; they cannot be provided for by a further issue of stocks or bonds, and while the property of the Company is increased in value its liabilities are not enlarged. * * * As the opinion of well informed men is always desirable, I have laid this plan before my honored and esteemed friend, Mr. James Alfred Pearce, of Chestertown. We served together in the late Maryland Tax Commission, and my contact with him taught me to entertain the highest respect for his judgment. He wrote me the following letter which he has authorized me to use:

DECEMBER 9, 1889.

Charles M. Armstrong, Esq.:—My Dear Sir:—I have read the bill you propose to submit to the Legislature for the government of the Consolidated Gas Company, and I believe it will commend itself to those who examine the subject carefully. I am satisfied that great municipalities ike Baltimore should either own such natural monopolies as gas works, or should derive some adequate profit from the franchise enjoyed by the private owners.

It is probably not practicable at present that the city should purchase and operate the gas works, and if the corporation should accept the conditions proposed in your bill I believe the benefit would be mutual.

The stockholders may be relied upon to see to it that the corporation receives a proper consideration for coming under the conditions you propose, and the Legislature should exercise equal care and discretion in securing reasonable economy and satisfactory service to consumers. I am not perhaps as familiar with the subject as may be thought desirable for the expression of an unqualified conviction, but I think I am sufficiently so to warrant the opinion that the granting of the exclusive privilege for a limited period under proper restrictions is sound public policy, and that your bill appears to be properly guarded in its details for the control of the corporation.

Prof. Ely states that in Berlin the public gas works supply gas for less than $1 a 1,000, and yet the profits defray 18 per cent. of the municipal expenses, while in the city of Wheeling, West Va., gas is supplied at 90 cents per 1,000, and the city derives a profit therefrom. These instances would seem to indicate that the price fixed by your bill, $1.25 per 1,000, may be too liberal, but as the bill also requires the payment into the city treasury of all the clear profits beyond 6 per cent. dividends on stock and 1 per cent. for sinking fund, with 10 per cent. of the city's profit for betterments of plant and of extension of service, this objection, if such it be, would seem to be corrected.

The privilege of renewal on same terms, including cost of gas to consumers, I think should not only be subject to the condition you propose, of one year's notice prior to the expiration of the term, that the city will not so renew but to the further condition that the city shall have the right to purchase the works on the same notice, at the par value of the stock and the assessed value of all real and personal property of the corporation which may be additional to the stock, the price to be paid either in cash or in 6 per cent. bonds of the city, as may be determined by the city. If your estimate of the profit to the treasury is substantially correct, the city could accumulate in 25 years a fund probably fully adequate for the purchase. Yours, truly, JAMES A. PEARCE.

I have also shown the bill to and discussed it with my friend and former associate in the tax commission, Dr. Ely, of the Johns Hopkins, with whose learning and public spirit you are all familiar; he heartily approves the regulation and control of such industries, both with a view to secure good service and to obtain a profit for the public, and considers this bill a move in the right direction, provided the proportion which the Company may apply to expenses is rigidly limited.

As the Doctor favors municipal ownership and administration of gas and similar works, he suggested provision for the purchase by the city at the end of the term.

2d. *The Interests of the People as Individuals* (*Consumers and Taxpayers*).—A great deal has been said under the former head that is also appropriate to the present. Therefore I will be able to abbreviate this section very much.

As a means for obtaining a contribution from individuals for the public treasury I consider a tax on the earning of the gas supply well adapted to distribute itself fairly, to reach everyone, and to put the heaviest part of the burden on the wealthy and well-to-do. Persons in comfortable circumstances light their houses from top to bottom at nightfall, they usually keep late hours, and their servants burn the gas freely and often lavishly. I have known servants to burn the gas jets in their chamber with full head of gas on for hours in the evening and all night long, "to keep it warm," though they were not in the room until bedtime, and, of course, were asleep from then until morning. But the family of the poor man, as a rule, burn only the one light in the family living room. The gas is only lighted in their chambers when they are about to retire, and is extinguished as soon as they are ready to lie down. Moreover the working people keep much earlier hours than persons of larger means. In short, they burn fewer lights and for a shorter time. Indeed it is surprising to note how the number of lights used and the time for which they are burned as a rule are in strict proportion to the means of the family using them. Those in moderate circumstances use more than the poor, but much less than the wealthy. I have had perhaps exceptional opportunities to compare gas bills, and have observed how, when the bill of a family in very moderate but still comfortable circumstances amounted to $2.50 and $3, that of opulent acquaintances ranged from $15 to $18. I have noticed the same difference in churches. The more wealthy provide themselves with abundance of temporal light to worship by. The poorer are economical of material illumination. So the corner grocery needs but a few jets, while the large salesrooms and counting room are brilliantly lighted from many burners. * * * The price fixed in the bill is a reasonable and moderate one, being lower than most other cities in this country. In London,

England, I learn the price is $1.18 (?) per 1,000. The gas companies there are permitted to appropriate the profits to the extent of a 10 per cent. dividend of their stock. The difference between $1.18 and $1.25 does not make much of an allowance for the difference in wages between Baltimore and London. There is still greater difference between wages of Baltimore and Berlin.

I think it probable that when the city's share of the profits reach a million dollars the time will have come to provide for making a reduction in price. Just now, all things considered, $1.25 seems a reasonable price if the city is to share in the profits. * * * Up to 1886 any company could come here and incorporate under the general law and tear up our streets and lay pipes. The first company to enter a place naturally lays its pipes to supply the whole community, including the outlying districts where it can make but little or no profits; when a new company is formed it needs only to have enough cash capital to enable it to run a year or two at a loss. It has but a small business, and therefore the actual sum of money lost by it is small compared with that lost by the old company. The old company is doing a large business at a loss. It is only a question of what terms the new company will accept. It forces a consolidation in time on terms highly favorable to it. Now, I desire to say to the Directors of the Gas Company that I do not propose to try to reconstruct the past, but accepting the situation as it is, I want to apply a remedy which, while it benefits the city and the public, will also, in my judgment, be a very advantageous argument to them. It is true that the London Companies get 10 per cent. dividend, while I only propose 6 per cent. for the Baltimore Company; but in view of the fact that your stock is somewhat swollen I think that is fair. Then a larger dividend would be proper if you were engaged in an enterprise which was experimental and involved risk. Your business is established and safe. The only risk is that of a company obtaining a charter and making war, and the 25 years of exclusive right conferred by the bill protects you against that. With the expiration of the first term of 25 years the sinking fund will be sufficient to retire your bonds. The provisions of this bill are liberal to you—made with the express purpose of inducing you to consent to them.

It provides for your security where you now have none. It makes your capital stock good, dollar for dollar, and it insures you the opportunity to make a dividend.

To the public I would say that, after all, $11,000,000 is not so great a capital stock. I understand that New York gas stock amounts to about 40 or 45 million dollars. What an advantage it would have been to New York if she had adopted a plan like this when her stock amounted to but 11 million dollars.

## Remarks on the Methven Paper on Photometry.

When Mr. Methven had finished the reading of his paper on "Photometry" (Southern District Association of Gas Engineers and Managers), the Association decided, in consideration of the importance and complexity of the subject, to postpone the set discussion until the meeting in February. The appended remarks were, however, made at the session at which the paper was read. Our report of same is taken from the London *Journal:*

The President said he had listened with a great deal of pleasure to Mr. Methven's excellent paper. It certainly must have taken him a great deal of time to prepare all the diagrams and drawings and the elaborate details that he had entered into—indeed, one could hardly conceive the amount of trouble that they entailed. The subject was one in which they were all directly interested. The Engineers of the South Metropolitan Gas Company were passing through the thraldrom of changing photometers. They might be altered and improved; but the question was whether they were not being improved in the wrong direction. He trusted there would be a good discussion.

Mr. W. T. Sugg (London) said he thought the members would be prepared to hear a few words from him on this subject, because, as they were aware, it was one that he had studied in various ways for a great number of years; and he had contributed to the alteration of the photometers which the President did not seem particularly to like. The discussion of this paper, it appeared to him, ought to be taken at two or three different meetings. Mr. Methven had put together a work upon photometry, which would serve as a text-book for students who had to pass examinations in gas matters; and by the aid of the diagrams, they would be able to gain a large amount of information—more than they would be able to obtain from a great many text books. He was quite sure that it was impossible to discuss properly at that one meeting the questions Mr. Methven had raised in the paper. He thought he could himself keep on talking for something like two hours on the subject without making any great effort to do so, or exhausting the discussion of the many different points introduced. In looking through the paper, he had been wondering how it would be possible to take in the whole of the information in such a manner as to adequately discuss each of the questions Mr. Methven had brought forward. Each one was most important, and affected gas companies generally. With regard to the verification of the illuminating power of the gas as supplied to the public, in the first place, the author referred to the photometers employed. They had in the City of London a Board of Gas Referees; and they had the Gas Works Clauses Act, which ruled, he supposed, over the greater number of gas companies, and its provisions were incorporated in almost every Gas Bill—except in London. In this Act it said that the Evans and Letheby photometers were to be adopted as the instruments by which all verifications of illuminating power should be made. It did not exactly describe these instruments; but it left what he thought it should leave—a sufficient margin for the alteration of the two instruments, so as to make them as perfect as anything could be made up to the present time. They had in the Evans photometer what Mr. Methven spoke about—the 100-inch bar, with the wide scale. By moving the gas, instead of the candles (which had been done in Holland), the result was to get the wide scale which Mr. Methven advocated—no doubt with very good reason. The scale of the Evans photometer was a very wide one; and with the distance from the candles to the disc, there was sufficient illumination on the disc, so that the slight modification of the position of the candles in the direction of, or away from the disc could be very readily appreciated. It was only natural, therefore, that attention should be paid to this, in order that an operator could make up his mind as to when the two sides of the disc were equally illuminated, and so that they might obtain the same results from a great number of operators. It was a constant practice of his—in making discs, for example—to have two or three, or even half-a-dozen men taken out of the works to adjust the discs, so as to see whether they had been made right; and they found that, by carefully preparing the discs so that the sides were perfectly equal in the amount of spermaceti left upon them, they would not get half a tenth of a candle variation in different comparisons. But with regard to the Evans photometer, there had been some statements made which he took the liberty of remarking upon in the *Journal of Gas Lighting* some time ago, with respect to the form of the Evans photometer which was now used at Ladbroke Grove. The Evans photometer as it stood fulfilled all the requirements which were laid down by the Standards Department of the Board of Trade as a standard instrument—that was to say, it was so made that any number of them could be exactly reproduced; so that in any room where they were fitted, the same results would be afforded by any photometer. This was a very important thing, and a condition which was not fulfilled by the Letheby or any other open photometer, with the exception of the "Canadian" photometer adopted by the Canadian Government. In that case they made a room exactly of one size; and the "Canadian" photometer and a Letheby which was used in this room gave the same results. It thus amounted to practically the same thing as the Evans—except that in the one case the operator got inside the photometer, and in the other he stood outside. He (Mr. Sugg) thought the outside was decidedly the best position (laughter). He found that there was a great difference in the eyesight of persons working at photometrical observances. There were some who could better adjust the disc in a perfectly dark room than in a perfectly light one; and others who could better adjust the disc in a light room than in a dark one. This showed that the Gas-Works Clauses Act in recognizing these two distinct forms of photometer—although perhaps they did not know then that there was a difference in the sights of persons—seemed to have hit upon some form by which these two different defects and qualities of light could be both provided for in the making of photometrical experiments. The Evans photometer, if properly ventilated (as it could be), would give, he maintained, the most correct results that could be obtained from any form of photometer. It admitted of the improvement which Mr. Methven had shown them in the wide scale, because they could make the gas to move instead of the candles—in fact, it was open to any improvement that might be wanted in that direction. But he must say this in regard to the Evans photometer, that when it was first adopted by the Gas Referees, in 1869 or 1870, they prescribed an instrument as it was to be seen in his (Mr. Sugg's) office. They fixed the dimensions of the instrument, and arranged the way in which every one should be made. The consequence was that the whole of the London testing stations had them fitted up in just the same way. The first of these photometers was only 9 inches deep; and the latter ones were 12 inches. The difference

between the action of these photometers was great; and the narrow ones were not so well ventilated as the wide ones. This was a matter which might have been easily altered, if the Gas Referees had simply adopted the changes some years ago which they had now made, and let more air into the photometer. The Evans photometer would then have never required to be superseded by any other. Although Mr. Methven had not mentioned in his paper the alterations which had been made, he (Mr. Sugg) would do so. The changes which had been introduced in the Evans photometer were four in number. First, at Ladbroke Grove, there was a narrow photometer, which had had the funnels taken off the top, and holes made in it for the ventilation of the gas and candles. The disc was fixed, and the candles moved. The second modification was in the district of the Commercial Gas Company; and in this case the photometer was 12 inches wide, the disc was fixed, and the candles were movable as at Ladbroke Grove. But the two instruments did not give the same results. The third modification was at Cloth Fair. In that case the photometer was made with the candles, and the gas fixed and adjusted according to the "Instructions" of the Gas Referees. The disc here was movable. This was also a wide photometer. The fourth alteration was in the photometer at Hill street, Peckham; and this was one that the President was rather "down" upon. It was a narrow photometer—only 9 inches wide—with the disc movable, and the gas and candles fixed. Here, then, they had four modifications in London alone, besides the Evans photometers of the original pattern. Mr. Methven pointed out that, with these modifications, it was difficult to know exactly what quality of gas was being supplied to the public. Then they had a difference in the open-bar photometers, as they were called. The "Canadian" photometer had a chamber of the same dimensions all the way through, like the Letheby photometer at Lambeth, with the result that Mr. Methven had described, which was not at all favorable to the gas. Then they had another instrument known as the "Tooley street" photometer. This was very much like the Letheby; but with important modifications at each end. The lights were enclosed in towers; and the space between the two towers, where the disc traveled, was open. The next modification of this was what was called the "Tower" photometer, in which the lights were placed in two towers—one at each end—and the disc worked in a tube, which was enclosed. Then they had the different forms of the Letheby photometer in use in London. Mr. Methven said that these variations and alterations showed that the Gas Referees were not impartial. Now here was one thing he should like to say in justice to the Referees, and it was this—that no company, as far as he was aware, except the South Metropolitan Gas Company (and he thought the Gas Light and Coke Company had once) had made any complaint to the Referees about the photometers which were being used. His opinion was this, that if there was any idea on the part of the gas companies that the photometers by which their gas was tested were not proper instruments, and that they were not doing justice to the gas, an appeal to the Gas Referees should have been made by them; and then if they had shown any partiality after the appeal had been made, the matter would have been different. As to what Mr. Methven had pointed out with reference to the reflection from the backboard of the photometer, he did not think that any claim could have been made to that at all, because the companies were entitled (he believed that was granted by the Gas Referees) to the whole of the light that came from the burner and from the chimney; and there ought to be no impediment placed between the light and that chimney which would in any way diminish the light from the gas. With regard to the openings in the screen, it seemed to him that the apertures from which the light should come ought to be made larger, because if they had an opening in front of a burner, and let the light fall through it upon any object, they would find that, as they decreased the area of the opening, so the amount of light that came from the burner and fell upon the object placed a distance from it, would be lessened in proportion to the lessening of the disc. He had made his remarks so long already, that he was afraid to trespass any longer on the time of the meeting. He told them when he started that, like Mr. Methven, he had studied the subject of photometry for many years; but to deal more clearly with the many points that the author of the paper had brought forward, would take too long, and so he should confine himself to the observations he had made.

Mr. Frank Livesey (London) said he thought they ought to heartily thank Mr. Methven for the immense amount of labor he must have given to this question. He was sure the paper would be very useful to gas engineers. But he was rather surprised that they should hear something in praise of the candle, because Mr. Methven was one of the leaders in the movement for finding a better standard of light. Mr. Methven now said that candles were reliable; but he (Mr. Livesey) believed they were not so. A few days since he was with one of the Gas Referees, testing gas with candles; and in the course of an hour's time one test gave a result of 15.3 candles, while the next test, with another pair of candles, gave 16.2. This was a considerable difference; and the observation was made: "Well, the fact of the matter is, this is an apparatus for testing candles, and not gas." With reference to the alterations made in the Evans photometer, he was of opinion that they were anything but satisfactory. If the Gas Company were entitled to the value of the gas as it was determined in the old Evans photometer, they certainly did not get it in the new or altered form. This he could say most positively, because the gentleman to whom he had been alluding told him that it was most probable that the new form would give a candle less than was obtained previously. As to the new photometer Mr. Methven had introduced to their notice, it was impossible to give an opinion upon it until they had looked at it more minutely. There was this to be said about the Gas Referees—that they were studying the question of a new photometer, and had shown the engineers of the London gas companies what they proposed, and which would do away with many of the objections mentioned by Mr. Methven. For instance, he (Mr. Methven) wished to introduce dry air to the burner. Now, supposing they were testing with a 16-candle standard carbureted gas flame instead of candles, whatever the condition of the air, the gas to be tested and the standard gas flame would be both affected alike. No correction for barometric pressure would be required; only for the temperature of the gas. There were also other special points about the instrument, which were perhaps difficult to explain without a diagram. It was of an entirely different form to the bar photometer, and was triangular in shape. It also met the objection raised by Mr. Methven in regard to the chimney surrounding the burner; for, instead of burning the fixed quantity of 5 feet per hour, and then ascertaining its value, the gas supply was increased or reduced until a 16-candle flame was obtained. The rate of consumption was then observed and the illuminating power corrected to 5 feet per hour. By this plan the proper size of chimney could be determined, and it would not require changing, as the flame was always a 16-candle one. Any photometer which, like the Evans pattern, gave certain results at the beginning of the tests with a gradual improvement as the instrument warmed up, could not be a correct means of measuring the illuminating power of the gas. If gas companies, however, were entitled to have their gas tested in an Evans photometer of the old pattern, which gave a return of 16 candles, any new form of photometer ought to give the same value to the gas. He appealed to gas engineers in the provinces to help them in London, because what was being done in London would no doubt spread to other places. Mr. Methven's paper was a most valuable one, but to discuss each point raised therein would take a very long time indeed.

Mr. C. Greville Williams said that the subject dealt with in the paper was a very large one, and intensely interesting. Many of the points raised by the author had astonished and delighted him; but he did not feel capable of discussing them at once. However, he would investigate and study in the laboratory the various questions brought forward by Mr. Methven. There was one thing which had been referred to in the paper—namely, the effect of moisture on flames. In connection with this he might mention that some time ago he found that one of the testers every Friday watered the floor of the testing room—in fact, the floor underneath the photometer was saturated. From what he (the speaker) knew of the properties of water vapor, it seemed to him possible that the presence of moisture might take some of the energy out of the gas flame; but as it would also do the same to the candle flame, the final result of the presence of moisture in the air must be decided by experiment. The question of the action of moisture upon the illuminating power of the gas was one of very great importance; and he thought that in the future they would have to give very considerable attention to it. The London gas companies were undoubtedly being placed in a cruel position, and they would have to use every energy to see that what was being done was not more to their disadvantage than what had been done already. As he said before, he was not going to discuss the paper; but he had learned a great deal from it, and warmly thanked Mr. Methven for it. He should most certainly pursue the subject further in his laboratory, and he hoped other chemists would do the same.

The President said that the paper was indeed a very valuable contribution to the subject with which it treated; and he thought it ought to receive full consideration at the hands of the members. He would suggest that the discussion should be adjourned to the February meeting, so that in the interval it could be thoroughly studied and experiments made, and then they would be in a position to deal with it in a more adequate manner.

The members having expressed concurrence in this proposal, Mr.

Robert Morton (London) said he would move that a very hearty vote of thanks be given to Mr. Methven. They had been deeply interested in the paper, and personally he did not know how to characterize the surprise it had given him. Not only the question of the effect of moisture on the illuminating power, but the entire paper gave them material to reflect upon. Every member would, he was sure, cordially agree with his proposition.

Mr. J. L. Chapman (Harrow), in seconding the motion, said that Mr. Methven had dealt with the question so fully that it was hardly possible to say anything further upon it. He had, however, placed before them much new material; and the best thing they could do was to go home and think over the matter during the next three months, when they would be better prepared to express their views on the subject.

Mr. Methven said he was much obliged to the members for the kind reception they had given to the paper he had read. He had hoped they would have been able to thrash it out thoroughly at this meeting, and so put an end to the strain that had been on his mind during the previous few days. But to a certain extent he felt pleased they had decided to withdraw any further discussion until a future occasion. In the meantime he trusted that what he had written would be with them all a subject-matter of deep consideration. He was thoroughly convinced that the gas companies of London must endeavor to strike now, or else they hardly knew what would be in store for them in the future. They had hitherto submitted very calmly, and accepted everything the Referees had produced in the shape of photometers. They had had various forms of photometers; and it appeared that they had not done with them yet. What the result would be he did not know. However, he would reserve any further remarks until the termination of the discussion at the next meeting. He thanked the members for their indulgence and vote of thanks.

## The Utility of Water in Gas Manufacture.

By Thos. Newbigging, C.E.

[A paper contributed by the author to the proceedings of the November meeting of the Manchester District Institution of Gas Engineers.]

The first useful part that water fulfils in the process of gas manufacture is the work which it does in the ashpans under the retort furnaces. Raised to boiling point by the glowing coke, it gives off steam in considerable volume, and this rising underneath and between the furnace bars, contributes to the durability of these by keeping them in a state of comparative coolness. At the same time it tends to prevent or mitigate the soldering together of the fused portions of the fuel. In its passage through the hot coke the steam is decomposed into its constituent gases; the hydrogen adding to the furnace fuel, and the oxygen promoting combustion. A tidy fire about, with the ashpans charged with water and reflecting the bright fire between the bars, is one of the characteristics of good stoking. In the absence of this, though the settings were composed of gold and diamonds, the best results would not be obtained. Dirt and disorder are indicative of general bad working.

In the slaking or quenching of hot coke, water is a necessity. It is true that if the coke is drawn from the retorts into iron barrows, and a close cover placed over it, the confined gases in the absence of atmospheric oxygen will smother and gradually arrest combustion in the mass; and some managers resort to this method of dealing with the coke with a view to abating the nuisance of the escape of steam, charged with sulphurous vapors, from the retort house, and to preserve the coke for sale in a dry and bright condition. Where the production of coke is great, however, as in the case of large works, this is an inconvenient, if not an impossible method of dealing with the material. It is to be noted, further, that the quantity of water absorbed by the coke when it is slaked in the ordinary way is comparatively small, not exceeding on the average 14 per cent. of the weight of the coke in the first instance, and the bulk of this evaporates when the coke is deposited outside the retort house in the open air; about 3 per cent. being permanently retained,

The water which is found in the hydraulic main is due to the condensation of the vapor or steam which, coming from the retorts, is carried up the ascension-pipes along with the permanent gases and the heavy hydrocarbons, the latter being deposited as tar. The presence of this water is accounted for by its previous existence in the interstices of the apparently dry coal. It is also produced synthetically by the combination, brought about by the heat of the retorts, of a portion of the oxygen and hydrogen—two constituents of the solid coal. The quantity of water thus yielded varies with different coals, but the average yield may be set down at 16 gallons per ton. In my previous paper I explained that a portion of the steam from wet coal is decomposed in the hot retorts, being resolved into its constituent gases. It will be seen, therefore, assuming the correctness of this hypothesis, that two opposite processes are being carried on simultaneously in the retorts—the analytical and the synthetical; and this apparent inconsistency may be explained by the original character of the substances acted upon—the steam in the one instance, and the gases, oxygen and hydrogen, in the other—and their proximity to and period of contact with the hot surface traversed by them. It is, in fact, another case of blowing hot and cold with the same breath.

The strong affinity which exists between this water and the ammonia impurity in the crude gas causes the absorption of much of the latter by the former; and hence the ammoniacal liquor, which is, roughly speaking, a solution of ammonia. This, again, by reason of its affinity for sulphureted hydrogen and carbonic acid, absorbs a proportion of the gases named, reducing the amount of these impurities in the gas; and thus is produced the complex liquid designated "ammoniacal liquor." In all well regulated works the ends of the dip-pipes in the hydraulic main are sealed with this liquor in preference to tar, which not only offers greater resistance to the passage of the gas, but robs it to some extent of its richest illuminating substances—the volatile hydrocarbons—which would otherwise be retained in the gaseous condition. This liquor performs similar functions in the washers and scrubbers, where, in the finely divided state, its quality of absorbing ammonia, sulphureted hydrogen and carbonic acid is still further utilized.

In hot climates the crude gas can best be reduced to the temperature necessary to admit of satisfactory purification by causing water to trickle down the exposed surface of the condenser.

In the slaking of the oxide of iron and the lime with which the purifying vessels are charged, water again is indispensable; giving porosity to the materials, and largely contributing to their power of absorbing the carbonic acid, sulphureted hydrogen and other sulphur impurities. We thus realize the vast importance of the presence of water in the various processes of gas manufacture and purification.

I need only further point to the value of the water seal for the lids of the purifying vessels, in the hydraulic valve, in the station governor, in the gasholder tank, in the cups of telescopic holders, in the wet gas meter, and in the water slide pendant. The simplicity and efficiency, as well as the indispensability of its application in these different directions is so obvious that further comment is rendered needless.

Finally, water or water vapor is one of the products of the combustion of coal gas. This product is brought about by the combination, at the point of consumption, of the oxygen in the air, and the hydrogen in the gas.

In large cotton spinning and weaving mills this characteristic of the gas flame is of the utmost utility. Whilst not deleterious to the health or comfort of the workpeople, it improves the quality of the work by enabling the yarn to be spun and woven with fewer breakages than is possible in a dry, harsh atmosphere. In short, this method of illumination, because of its moisture-producing quality, will always commend itself as being the most suitable and natural under such circumstances.

It will thus be seen that the presence of water, whilst objectionable under certain conditions, yet plays an important, and indeed indispensable part in the economy of a gas undertaking.

## Electric Welding.

Mr. C. E. Harthan, in the course of a lecture, delivered before the Lynn (Mass.) Scientific Club, on the evolution of the process of electric welding, said that the present Thomson Electric Welding Company was organized in April, 1887, to perfect and introduce the new process. At the time the company was organized Professor Thomson and others interested had not made any special study of the present process of manipulations of welding, especially where it was done on a large scale under competition. All of these manipulations they had to become familiar with so as to work intelligently.

Welding machines may be divided into two classes—the direct welder and the indirect welder. The direct is a machine with the welding current generated at the armature and led to clamps directly over the machine connected by brushes bearing on copper rings. Some difficulty was experienced with it in different ways, such as bad contact at brushes, which was liable to occur, vibration of clamps by revolving armatures and motion of belt, also other causes from alternating currents, etc., although four or five of these machines first sent out are now running and doing perfectly satisfactory work. The indirect welder is a coil with clamps connected directly with welding circui and its primary current is obtained from an alternating current dynamo. The welding coil or converter is constructed with a primary and secondary circuit. The primary consists of a number of turns of wire, while

the secondary has usually but one turn, and that a casting or bar of copper, or a bundle of wires in form of a cable. The welding circuit or secondary is not completed until pieces to be welded are placed in the clamps and brought into contact by the pressure device. The dynamo is like in principle to ordinary dynamos for alternating electric lighting. There are several ways of regulating, one by means of a rheostat in exciting or field circuit, or by means of a variable reactive coil or as called the "kicker;" these are the two most common ways. The type of dynamo now commonly used is the compound excitation by special methods, which works very nicely; indeed, it takes care of itself during the welding, through a great range of sizes of stock. One of the greatest advantages of this type of indirect welders over the direct is that a number of coils can, if desired, be run from one dynamo, and the coils can be distributed around a factory or even around a city.

The welders for large work, as adopted now, are alike in form but vary in size, winding and clamps. The core, as it is called, is made of laminated sheet iron discs bolted together, with hole in the center large enough for secondary and primary circuits. The primary is made of coils of a few wound on a form and slipped on to the core through an opening which is afterward filled with laminated phig. The secondary is often a heavy copper tube or bar passed through the center of the core, connected at the two ends with copper castings, connecting with welding clamps, and in such case the joint at the end is made on a taper set up tight to insure contact with a nut, a thread having been cut on the end of a copper bar. This hole is placed on a proper base, with a sort of table at the top which supports the clamps and pressure device. The clamps are usually made with one clamp kept stationary during welding and one movable clamp, the pressure power being obtained by a screw worked with a worm wheel or ratchet. The welding dynamos are all similar in form, but vary in size and connections. The form is of frame, with field magnets projecting inward, having 4 and 6 field poles made of separate plates of iron securely bolted together and to the frame, the coils being slipped on in the ordinary way. The armature is a type of its own; it is a pole armature—that is, the core has 4 or 6 projections; the coils are wound on these. The lines of force do not pass through the core diametrically, but from one projection to the next. It cannot be called a drum armature, nor Pacinotti, nor Siemens, but perhaps a modification of the shuttle type. Perhaps the name multipolar Siemens shuttle might be suggested. The alternating current is taken off the collector rings in the ordinary way. The dynamos are divided into two different classes: The 2, 4 and 6 pole machine, also self-exciters, separate exciters, where fields are excited by small dynamos, and composite dynamo. They are generally wound for 300 volts and run at a rate of 100 alternations per second, or 6,000 per minute. The 4-pole are run at a speed of 1,500, the 6-pole, 1,000 per minute.

As the dynamo is doing work only at short periods and not constantly, the output is much more than it otherwise would be for the same size of machine for continuous work. They are built of much less weight for the same number of watts than an alternating lighting generator. Some of the first questions asked by a person who has seen the welding for the first time, are: How much power does it take? How strong are the welds? Can you weld all metals? How large can you weld? etc., etc. Electrical instruments are made for measuring different currents in many ways, where used for lighting, railways, etc., but none to measure welding currents. Here a difficult task was met with. Instruments are not made to measure such immense heavy currents; even if they were they could not be introduced in the welding circuit or secondary conductor of the welder, as it is so very short, only a few inches long, comparatively.

So instruments had to be constructed for the purpose, and the horse power has been measured in more ways than one. Electrical horse power has been compared with mechanical horse power from steam engine indicator, and as the different results agree very well, we think they must be very nearly correct.

Something over a year ago a series of power tests were made by means of the calorimeter. By this method the power at the point of the weld was determined, that is, indicated the power consumed in the weld itself outside of efficiency of converter, dynamo, etc.

Possibly some may not be familiar with this method; perhaps a brief description would not be out of place.

A calorimeter is an apparatus for measuring heat given out by a body in cooling.

The welding bar, at the welding temperature, is placed into a known quantity of cold water at known temperature. After the water has absorbed all of the heat it will from the hot bar, the temperature is again taken, and the power is calculated from the difference between the two temperatures of the water. The time of making the weld, specific heat of metal, etc., must be taken into account. It is necessary to know the temperature of the specimen before welding; the best way is to have specimens and the water at the same temperature before making the test. The result is calculated to foot-pounds. The result of tests made this way show that the average power consumed in a ½ bar of iron welded is about 6½-horse power, welded in 10 seconds; 1 inch round iron, 12-horse power, welded in 40 seconds; 1½-inch round iron, 18 horse power, welded in 90 seconds. Probably these results are not absolutely correct, as they were obtained from a very crude apparatus, but I think they are within 10 per cent.

The average horse power from a great number of tests is shown to be for ½ inch round iron, 9½-horse power in 10 seconds; 1 inch round iron, 20-horse power in 40 seconds; 1½ inch round iron, 37-horse power in 60 seconds, 1 minute; 2 inch round iron, 66-horse power in 80 seconds; 2½ inch round iron, 100-horse power in 135 seconds, 2¼ minutes. These results are based on 85 per cent. efficiency of dynamo. By comparison of these different results it shows that from 65 to 72 per cent. of the total energy of the engine is consumed in the weld.

The time taken in making a weld is a very important factor, as the quicker the weld is made the more power is consumed for the time. If a piece of 1 inch round iron is welded in 40 seconds, and requires 20-horse power, it would require about twice the power to do the same work in one-half the time, or about one-half the horse power in twice the time. This theory holds good within quite a wide range, perhaps 30 or 40 per cent. each way from the table just given.

If a weld is made too quickly the metal is burned at the ends in contact; if made too slowly, the machine and clamps are overheated, and energy is lost by radiation of heat.

Also the distance between the clamps is another factor; the less projection of the piece beyond the clamps the less power is used, as the resistance through the bar is lessened, but, as the pieces become heated to high temperature, the clamps absorb the heat and are also burned if too close. If too great projection is given much power may be lost from radiation, and a longer length of bar will be heated than is necessary. For heavy work, and that done continuously, it is found necessary to employ a method, already worked out in early welding patents, to keep the clamps cool; this is done by having them constructed with a circulation of water through them with the result of increased economy of power.

## Station Meters.

The following hints in respect to station meters is from the series of articles on the construction of gas works now being published in the *Gas Review*, from the pen of Mr. W. Ralph Herring:

The importance of the station meter in gas works, and more particularly in establishments where the utmost care and intelligence are necessary in order to earn a dividend, is hardly susceptible of exaggeration, for by this instrument all the gas produced is measured and recorded hourly and daily; it serves as a check on the quantity and quality of the coals carbonized, it shows whether the operations in the retort house are being properly and successfully conducted or otherwise, and so far as regards the production and sale of gas, it affords an unerring means of ascertaining the operations of the company. In addition to these, the station meter, when properly constructed, is amongst the most durable of all the apparatus on a gas works. Once placed, beyond being properly supplied with water, it requires no attention, and during a number of years is a faithful recorder of all the gas produced.

On the other hand, when this instrument is dispensed with, it is practically impossible to ascertain with any degree of accuracy the quantity of gas manufactured and sold. To determine this in its absence, constant reference has to be made to the gasholders, the contents of which are continuously influenced by every change of temperature of the atmosphere—perhaps at one hour, in consequence of the gas being expanded by the heat of the sun, showing an extraordinary, fabulous make, and at another period, with reduced temperature, no production whatever. Moreover, when a holder receives and delivers the gas simultaneously, it is utterly impossible to ascertain the quantity produced. It is obvious, therefore, on these accounts that for economical working the station meter is indispensable. For this purpose that known as the "wet meter" is universally adopted. In some few instances the "dry meter" has been tried for the purpose, but has invariably resulted in failure, occasioned by the large accumulation of condensed liquid therein, which impedes its action; therefore, however desirable under certain circumstances for consumers, the dry meter is quite unsuitable as a station meter for gas works.

Considering the most important and delicate functions of the instrument in question, it may be classed among the simplest of mechanical contrivances, yet, in consequence of its peculiar formation, it is one of the most difficult to explain without the aid of numerous diagrams. However, it may be simply described as a cast iron case, containing a cylindrical vessel, usually termed the "wheel" or "drum," which revolves freely in a horizontal position in suitable bearings. This wheel is divided in a certain number of even compartments (three being now much advocated), each having its corresponding inlet and outlet. The case is charged with water to a short distance above the shaft of the wheel. The gas entering one of the compartments by the force or pressure it possesses expels at the same time the corresponding gas in another compartment. Thus at each revolution of the wheel it receives and expels a certain amount of gas equal to its capacity, and this being known, then by suitable wheelwork the number of revolutions of the wheel, or the quantity of gas passing through the meter, is indicated on the dial or index.

When constructing meter wheels, their approximate capacity is obtained by calculation, but the exact position of the water line is ascertained by experiment. It is then carefully marked on the front of the case, so that in the event of the gauge glass being broken the mark is always retained. A much better method is to attach a brass plate to the case, having the words "water line" engraved thereon.

The causes of the friction or pressure required to work a meter are not generally understood, hence various absurdities have from time to time been patented in order to diminish this, amongst which glass axle bearings have been proposed, but it must be evident, from the facility with which a meter wheel revolves in its case when there is no water therein, and the difficulty with which it moves when charged with water, that the cause of obstruction must arise from that alone.

The drum partitions are placed at an angle so that in revolving they form a kind of vane or screw, and whilst in action draw a small portion of water through the center opening, and which is expelled at the back of the wheel. A similar result, although in a very slight degree, is effected by the inlet and outlet hoods. Under these circumstances the orifice in the hollow cover should be of ample capacity, in order that the water may pass there-through with all possible freedom, and further, that a meter may work with a minimum of pressure, care should be taken to make the passages at the center of its wheel communicating between the various chambers sufficiently large, so that the water may flow freely into and from the chambers during the revolution of the wheel. By inattention to these points the friction or pressure required to work the meter is materially increased, and by due regard thereto it may in like manner be diminished.

The dials of station meters, unlike those of consumers' meters, are made so that the pointers all revolve in the same direction. The dials are arranged upon a circular disc, and occupy the lower portion. An eight-day clock is placed above the index, and in the center a circular disc, with arrangements made for attaching a card of similar size thereto. The outer ring of this card is divided according to the maximum production for which the meter is estimated. The minute hand of the clock at a short distance from its axle is provided with a projecting stud or pin, which is connected to and actuates a rod, at the end of which a pencil is held pressed by a light spring which marks the card. Thus by the action of the minute hand of the clock, the pencil is caused to move to and fro in a vertical direction, and if the card were stationary the pencil would simply make a vertical line, but as it rotates, so, in direct proportion to its speed, is formed a curve of greater or less length, which, corresponding with the divisions on the card, records the quantity of gas passing through the meter each hour during the day and night. A fresh card is placed on the disc each day. This instrument is termed a "tell-tale," and is both ingenious and useful, and its application is worthy of extension into small works, where the number of men employed is limited to two or three at each "shift," for in such case a spirit of rivalry often exists amongst them, when at times it is difficult to ascertain the results of their respective operations. This difficulty the tell-tale is well calculated to remove.

It is most important that the water-line in the meter be kept at the proper level, otherwise whenever it is above this point, the capacity of the "wheel" is diminished, consequently the instrument indicates a quantity greater in proportion than that which has passed therethrough, and is technically termed fast. If, on the other hand, the level of the water is below its proper position, the wheel is increased in capacity when the meter indicates less than the quantity passed and is "slow."

It is very important that the meter be placed on a suitable foundation, and it must be perfectly level, otherwise its accuracy will be affected. The meter should be provided with proper connections, and inlet, outlet, and by-pass valves; thus, in the event of anything happening, the meter can be thrown out of action immediately and disconnected for repairs without interfering with the carbonising operations. The water level is best maintained by allowing a very fine stream to flow in at the inlet water syphon, a corresponding amount flowing over the outlet. In this way all evaporation is compensated, and the water kept clean and fresh.

## Suspension for Arc Lamps.

The accompanying illustration outlines a neat contrivance for taking up the slack of the leads to arc lamps, and thus avoiding the untidy effect of loose conductors. Each conductor is wrapped around a double-grooved spring winch, which has a constant tendency to coil up the wire on both sides of it. The lamp is hung in the usual way by a steel

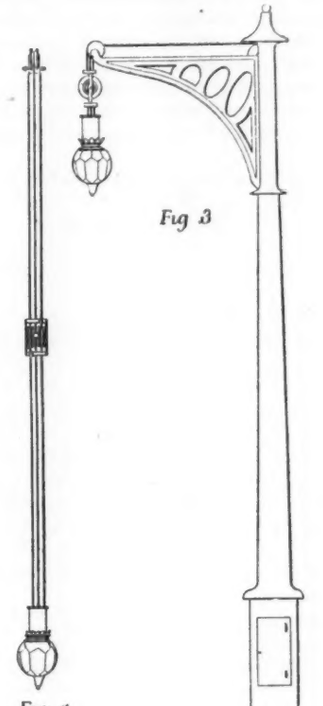
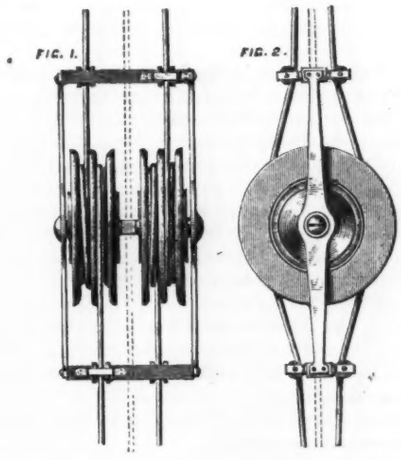


Fig 3

Fig 4.




wire strand connected at the other end to a small capstan or to a balance weight. When this strand is paid out to lower the lamp the spring winch rotates as it descends, unwinding the coiled conductor (Fig. 4). When the lamp is again raised the spring winch climbs up the conductors, rolling them up above and below it until it attains the position of Fig. 3. The inventors are Messrs. Sayers and Sturge, and the makers Messrs. Charles Joyner & Co., of Icknield Square, Birmingham, Eng.

### A New Method of Constructing Scaffolding.

At the Congress of the Sanitary Institute (Worcester, England), Mr. G. Beck contributed a paper on the above-named subject. In the course of his remarks the author said:

The subject of the paper which I have the honor of placing before you is scaffolding, and although scaffolding is neither food nor physic, yet, as it contributes to the preservation or destruction of life and limb, it has something to do with sanitary science.

It will hardly be disputed that to no other building appliance is attached such grave responsibilities. Scaffolding should be safe, beyond all doubt, and suitable for the particular purpose to which it is applied; yet, strangely, no appliance, among a large class of builders, receives so little attention, the common method being a rough-and-ready mode of placing together anything to hand, and using it as scaffolding. Accidents frequently arise from such improper constructions, the not unfrequent reports of which in the newspapers impressed me, and induced me to construct a cheap safety scaffolding that would not only be a protection to life and limb, but would also effect a saving in wear, tear and maintenance. Pursuing this idea to a practical issue has resulted in an invention which, carried through many modifications, and, with the valuable assistance and advice of some of the largest builders and most practical men in this district, I now believe to be in principle practically perfect.

In dealing with this invention I have kept before me:

First. To make a structure safe, adjustable, portable, and in itself independent. Second. To construct it so as to adapt it to a variety of purposes and uses. Third. That the cost of its production and maintenance should be moderate, and if possible relatively cheaper than good ordinary scaffolding.

For scaffolding I use vertical poles, advantageously of square wood, having holes or slots formed therein at equal distances apart. These holes or slots serve to regulate the height of each tier or platform. Each pole is fitted at one end with a metal socket or shoe, into which another pole is inserted to increase the height of the standards or poles supporting the remainder of the scaffolding. I provide, also, horizontal putlogs (square by preference), fitted at each end with metal brackets, having holes or slots formed therein to correspond with and fit over the pole holes, to which they are secured by screws or bolts. Square section ledgers, fitted at each end with metal brackets, similar to those on the putlogs, with the addition of two or more ears to each, and with a swivel plate at the head of the bracket, to use when required to secure returned scaffolding.

All holes in the structure correspond, so that all pins or bolts used to connect the parts are interchangeable.

To effect a return portion of scaffolding, one hole is made in the center of each ledger to correspond with and fit the hole in the swivel plate before mentioned at the head of the bracket. Other holes are made in the ledgers adapted to fit swivel angle plates, secured by screws or bolts.

An adjustable ladder in short lengths fitted with sockets to lengthen it out as required by the height of the scaffolding, is also applied. The ladder or sections thereof is secured to the putlogs or ledgers with metal clips.

The putlogs or ledgers can be used at convenient heights on any or every tier to guard workmen from falling off the platform or stages.

The ladder can be used inside the scaffolding when the whole is self-contained. The scaffold may be either single or double, and is absolutely rigid. It has also a further adjustment, so that, when extra bearing power is required at a given point, the interchangeable parts will discharge this service, and this, joined with its capacity of standing firmly and independently of the building, renders it specially adapted for the erection of stone-faced buildings, church spires, and the like. It is also very suitable for large interiors, its short length poles enabling workmen to take it easily in and out of small or cramped openings.

It is applicable, also, for the construction of shedding, shopping platforms, or fixtures, movable buildings, colonial houses, or the like.

It can be stowed away into limited space, or even into itself, thus forming its own storage shed.

No skilled labor is required for its erection or removal; ordinary intelligence can perform the operation.

Its wear, tear and maintenance would compare very favorably with the present mode. Rope, a costly item, which soon decays, and being of marketable value, is liable to be stolen (which applies to chains), is not used in this scaffold.

Cost of production can at present be only approximately arrived at. From information obtained from a reliable firm in the timber trade I learn that suitable timber ready for use may be bought as cheap or cheaper than good poles. The iron work can be made in malleable cast steel (annealed) very cheaply, and considering the matter all round, including wear and tear, it may be estimated at about two-thirds that of the present scaffolding when properly erected.

### Influence of the Percentage of Ash in Coal on the Yield of Coke.

Dr. F. Mucke, a German authority, who has prepared an exhaustive treatise on the manufacture of coke, thus treats this portion of his subject. In some of the earlier chapters the Doctor explains that be had not considered the percentage of ash contained in the coals examined, in so far that all the figures given in connection with the yield of coke had reference to coals and cokes reckoned free of ash. The reckoning followed the formula $C^1 = \frac{(C-A)\ .100}{100-A}$ in which $C^1$ represents the yield of coke free of ash, C represents the yield of coke containing ash, and A represents the quantity of ash contained in the coal. Hitherto, also, he had considered only such coals as were comparatively low in ash, containing not more than 10 per cent. A larger proportion of ash than this has a very marked influence on the behavior of coal in crucible coking.

Very impure coals, that is to say, coal high in ash (cores from bore holes, for instance) give, by coking test, always a sooty black coke with little or no luster, and even when containing a large proportion of hygroscopic water, they give in the beginning a clear, luminous flame, which, however, very soon gives place to a long-continuing flame of very little luminosity. The absence of luster in the coke cannot be prevented, since the high percentage of ash must always stand in the way of a perfect fusion.

Numerous experiments have fixed beyond a doubt that in the cases where the percentage of ash reaches a certain height, the products of distillation that escape and are lost are not only less, but they are also different and lower in carbon than when the same coals with less ash are coked. Thus, one grain of a coal containing only 3.7 per cent. of ash was mixed with powdered quartz, previously roasted, in such proportions that three samples contained 30, 50 and 60 per cent. of the quartz, respectively. These mixtures, on being coked with strong heat in a platinum crucible, yielded:

| | Per cent. of coke reckoned on the basis of the coal free of quartz. |
|---|---|
| 1. From a mixture with 30 per cent. quartz.... | 74.88 |
| 2. " " " 50 " " .... | 76.22 |
| 3. " " " 60 " " .... | 79.31 |

All the resulting specimens of coke were alike in being but little swollen, while the upper surfaces were broken out in a "bud-like" way. In other respects, however, they differed as follows:

1. Compact, well coked, with graphitic luster.

2. More friable than No. 1, sooty black, almost lusterless, with a few loose balls of coke about the size of grains of millet lying on the upper surface.

3. Very friable, entirely lusterless, with numerous balls of coke on the surface.

Flames broke out as described above in the case of coals high in ash.

The following table is from a fuller series of experiments made by H. Schulze, M.E. It gives, side by side, the yield of coke from coals low in ash, and from coals high in ash or mixed with quartz, as, also, from mixtures of other organic substances with quartz:

| | Coke. | Ash. | Coke. | Ash. |
|---|---|---|---|---|
| Coal from the Gluckhilf group near Waldenburg..... ..... | 67.70 | 2.3 | 71.80 | 13.7 |
| Coking coal from Waldenburg. | 68.23 | 3.1 | 72.40 | 49.3 |
| Cannel coal from Newhaven... | 41.68 | 3.2 | 42.63 | 27.0 |
| " " " " ... | — | — | 45.88 | 76.7 |

| | Coke. | | Coke. | Ash. |
|---|---|---|---|---|
| Starch..... | 4.57 | (Free of ash without quartz) | 5.62 | 22.0 |
| | — | " " " " | 7.10 | 45.7 |
| | — | " " " " | 10.07 | 67.1 |
| Dextrin..... | 4.36 | " " " " | 5.13 | 20.0 |
| | — | " " " " | 7.43 | 50.0 |
| Cane sugar... | 9.24 | " " " " | 10.84 | 25.2 |
| | — | " " " " | 14.15 | 70.5 |
| Sugar of milk. | 3.28 | " " " " | 5.30 | 23.5 |
| | — | " " " " | 6.24 | 44.7 |

The neutral inorganic substance, quartz, works through absorption of heat, or, more correctly perhaps, as a poorer conductor of heat, laid between the particles of coal or other organic substance; it works to heighten the yield of coke, as does every other condition which tends to lower the coking temperature.

Although it is demonstrated, on the one hand, that a considerable intermixture of a neutral mineral substance increases the absolute (free of ash) yield of coke, and thus makes the figures for the yield of coke free of ash, in a measure, uncertain, it must still be remembered, on the other hand, that the natural ashy matter of mineral coal is rarely, perhaps never, a neutral body like quartz. The natural ashy matter of mineral coal cannot gain any weight in the process of coking (as can ashy matter that is added to the coal), when no compensation takes place; on the contrary, the natural ash will suffer a diminution of weight where it—as undoubtedly is frequently the case—consists of watery clay silicates, which lose their water by calcination. In this case, however, the proportion of volatile constituents found in the process of coking will obviously appear too high, since the loss by calcination of volatile matter is added to the water of hydration freed from the ashy matter. This must always be considered in the examination of any coal, whether by chemical analysis or coking test—particularly if, as may be the case in testing a boring, comparatively pure coal is not procurable.

The absolute (free of ash) yield of coke may be very low, even from certain high-ash coals, especially from bituminous shale impregnated with mineral coal; and this is not because these fossils have a large quantity of water of hydration in their ashy matter, but because they contain, in their carbonaceous matter, a large quantity of hygroscopic water, by means of which much even of the carbon is driven off.

From the above comparisons it is clear that for an exact examination of coals, chemical analysis and the coking test must supplement each other; and, especially in the case of impure coals, a most important check is given in the quantity of the hygroscopic water, which, of course, belongs only to the carbonaceous matter.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

"Dear Journal: After two or three weeks of wandering through the great Northwest, I find myself temporarily located in Duluth, Minn., which I believe was once introduced to the notice of the country as the zenith city of the unsalted seas. Well, prairie lands and the like may resemble unsalted seas, and Duluth may be pretty close to the zenith, but there is no 'may' about the fact that Duluth stands on a very firm foundation. The latter is nothing more nor less than a mass of blue granite rock, which means that excavations for gas and water pipes are only obtainable at the expenditure of much labor and more money. When Mr. William Craig was appointed Superintendent of the Duluth Gas and Water Company, he took hold with the understanding that his new field did not comprise the territory best suited to the holding of a sinecurist's position, and not only so, but that public prejudice against the manner in which this dual enterprise had been conducted must be met and turned into public favor. I imagine that he has succeeded completely in the latter attempt, and that a good part of his victory is attributable to a judicious expenditure on plant enlargement. Previous to the present year the gas service was carried on through a main mileage not exceeding 18, while in 1889 no less than 12¾ miles of new pipe were put down—75 per cent. of which had to be laid in trenches cut through the solid blue granite. In addition to this a new manufacturing plant (and a 250,000 cu. ft. holder) was constructed, the capacity of which is returned at 500,000 cu. ft. per diem. Of course in a letter like this I will not pretend to be minute in details, but a good understanding of what has been done can be had when I say that the Company's expenditure on plant improvement this season (the water works division of the enterprise being included) cannot have been short of one-half million dollars. The result, however, is already apparent in the increased business enjoyed by the corporation, the proprietors of which are evidently determined that Duluth is to have plenty of light and water.—***"

New Haven's public lighting department for the year to end December 31, 1890, it is estimated, will call for the expenditure of $66,951. Of this amount $29,000 is set apart for arc lighting; $21,500 is charged up to gas street lamps; gas for public buildings is estimated at $2,000, and naphtha lamps are to absorb $12,000. New Haven pays her lamp inspector $1,200 per annum. In the estimate we note that each gas lamp is to cost $25 per annum, and that $22 is allowed for each naphtha lamp.

Some time ago we noted that attorneys Hargis & Eastin had brought suit against the Louisville (Ky.) Gas Company for a big contingent fee, which they claimed had been earned by them in connection with their efforts at a settlement of the war of rates between defendant Company and the Citizens Gas Light Company—the attorneys had been paid the sum of $500 when they were originally retained. A fortnight ago the Louisville Company filed answer to the suit, which, in addition to a general denial of the plaintiffs' claim, also contained the plea that because of a preliminary injunction, which Hargis & Eastin failed to have dissolved, the Citizens Company, which had for months been making and vending gas, was enabled to vend gas until the final hearing of the cause. Knowing that the same would be greatly delayed, the Louisville Company, in order to avoid the ruinous competition that existed, was compelled to buy the stock and bonds of the Citizens Company in 1886, and that this result was secured without any assistance from Messrs. Hargis & Eastin, who, the defendant asserts, were amply provided for in compensation through the absolute fee of $500 paid to the plaintiffs.

Interested parties having circulated the rumor that the interests of the Bloomington (Ills.) Electric Light Company were identical with those of the local Citizens Gas Light and Heating Company, the proprietors of the latter have been moved to make the following denial: "We propose to enter the field as a direct competitor of the Bloomington Electric Light Company, and we are prepared to offer electric light at a much lower figure than they are attempting to contract for. Parties contemplating the use of electric light, either arc or incandescent, will do well to see us before closing any contract. We are pushing our works as rapidly as possible, and expect to be able to supply light within 30 days."

President Cressler, of the Kerr Murray Manufacturing Company, writing under date of the 14th inst., says: "We are just now engaged in finishing up our contracts for 1889, which has been one of our most prosperous years. Among orders booked since June 1st we note the following: Rebuilding the works at Janesville, Wis.; Delaware, Ohio, and Kankakee, Ills., the apparatus and plant construction furnished consisting of wrought iron roofs, benches, boilers, exhausters, condensers, scrubbers, purifiers, oil tanks, meter bye-passes, governors, etc.; purifiers, center-seals and connections for Oberlin, Ohio, Aberdeen, South Dakota, and Green Bay, Wis.; coal benches for Alton, Ills., Steubenville, Ohio, Erie, Pa., and Oberlin, Ohio; three cast iron Arndt water gas washers for the Chicago (Ills.) Gas Light and Coke Company; telescopic gasholder in steel tank for Joliet, Ills.; also, single-lift holders for Pontiac, Mich., Grand Forks, North Dakota, Aberdeen, S. D., Creston, Iowa, Kenosha, Wis., and the Citizens Fuel Gas Company, Terre Haute, Ind. A complete new six-inch coal gas plant for Du Quoin, Ills., comprising retort house roof, benches, pipe condenser, washer, purifiers, gasholder, lamp posts, etc. We also rebuilt the gas works at Johnstown, Pa., that were destroyed by the flood, part of the apparatus furnished at that point being a telescopic gasholder, 12-ft. purifiers, etc. We also put up a 9-ft. fuel gas generator, under the Evans process, at Jackson, Mich. The prospects for 1890 are very flattering, and we anticipate a rush of orders." Lists like the above go far towards proving that gas is to be the light of the future as well as the light of the present, and we think the fraternity will join with us in congratulating busy President Cressler on the result of his doings in 1889.

We are requested to say that Mr. Samuel Booth is not now connected with the Warren (R. I.) Gas Light Company.

The suit brought by the Cedar Rapids (Iowa) Gas Company for damages against the Chicago, Milwaukee and St. Paul Railroad Company is being tried in the United States Circuit Court, Dubuque district. Complainant asks $20,000 for "abutting damages" to its property on First street, close by the defendant's freight depot.

The Congaree (S. C.) Gas and Electric Company has declared a dividend of 2 per cent., payable Jan. 1st.

The proprietors of the Newport (R. I.) Gas Light Company have notified the consumers that on and after Jan. 1st the net rate per 1,000 cubic feet is to rule at $1.50. This is equivalent to a concession of 20 cents per 1,000, which is beyond doubt a most reasonable rate. Work on the auxiliary water gas plant is well underway.

A project is on foot for the construction of a gas works at Hammonton, N. J. This place is a post village of Atlantic county, N. J., and is about midway of Philadelphia, Pa., and Atlantic City, N. J., on the Camden & Atlantic branch of the Pennsylvania system. The principal industries are the manufacture of boots and shoes and the raising of small fruits. Population, about 4,000.

The Vice-Chancellor of New Jersey has decided that he has no power to enjoin the new Company at Elizabethport from proceeding with the

construction of its works, and that complainant (the Elizabeth Gas Company) must institute *quo warranto* proceedings in the Supreme Court. We understand that the complainant has appealed from the Vice-Chancellor's decision to the Court of Errors and Appeals, and that it will also institute the *quo warranto* procedure suggested in the adverse decision.

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In connection with the Vice-Chancellor's decision in the above-named case, the following abstracts may prove of interest. The Vice-Chancellor says: "The complainant was made a body corporate in 1855, by special Act, for the purpose of making and selling gas in the city of Elizabeth. It had the privilege of laying pipes in the streets of the city and do other things necessary for accomplishing the purposes of its creation. It has established works at a cost of about $500,000, and has been in active operation for 20 years. The defendants are 10 persons who have begun to exercise the same privileges and admit that they intend to compete with the complainant. They claim no right as natural persons, but say the franchises belong to the Metropolitan Gas Light Company, of Elizabeth, and that as officers of that corporation they have a right to exercise the franchise in question." Having thus stated the standing of defendants, the Vice-Chancellor thus decides the legal aspect of the case: "Nobody can take advantage of the breach of the condition on which a corporation is created, for the purpose of depriving it of its franchises, except the sovereign power which created the corporation. A court of equity has no authority in virtue of its general jurisdiction to dissolve a corporation and deprive it of its franchises for either non-user or mis user of its corporate power, nor because its organization was not effected in accordance with the requirements of the law by which it was created, but in violation of them. An inquiry whether a corporation exists *de jure* or not is beyond the power of a Court of Chancery. Whenever it is sought to impugn the legality of a corporation which exists under forms of law, the remedy is by *quo warranto*, or information in the nature thereof, instituted by the Attorney-General. But a court of equity has power to protect a corporation holding an exclusive franchise from irreparable injury arising from the usurpation of a like franchise. Where a statute creating a corporation declares that unless the corporation performs certain acts within a specified time after its organization its corporate existence and powers shall cease, or its powers and franchises shall terminate, it has been held that the statute executes itself, and that if the designated acts are not done within the time limited, the corporation ceases *ipso facto* to exist, and the fact that it has by its laches lost corporate life and power may be alleged and proved in a collateral proceeding."

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The United Gas Improvement Company is pushing construction under the contract recently awarded it for a complete water gas plant (Lowe type) for the Terre Haute (Ind.) Gas Company.

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The proprietors of the Holyoke (Mass.) Water Power Company, who are also in control of the gas supply of the city, have announced that from and after January 1, 1890, any single consumer whose use of gas per annum shall have been shown to have been equal to 360,000 cubic feet, shall be charged at the rate of $2 per 1,000, with a discount of 35 per cent. to be granted in all cases where the monthly statements of the quantity of gas used have been settled within 5 days from the date of presentation.

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Manager Gray, of the Aberdeen, S. Dak., Gas Light Company, is our authority for the statement that gas will be turned into the mains on or before January 1st. This is rather quick work, but Mr. Gray was always on the energetic order.

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Mr. M. V. Smith, of Pittsburgh, Pa., is erecting a fuel gas plant for firing the boilers of the station of the Central Thomson-Houston Electric Light Company, of Boston, Mass.

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A Bangor (Me.) gas man recently explained that a peculiar case of "beating a gas meter" once came under his notice. This gas thief cut the pipes on both sides of the meter and jointed them. When the Company's inspector had read the dial the "customer" would unscrew the joints and bye-pass the meter by means of a rubber tube. A week or so before the inspector was expected the tube would be removed and the pipes screwed up. An unexpected visit by the meter man revealed the fraud.

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The Supreme Court of Louisiana has just reversed the decision of a lower court, under the ruling of which the heirs of an employee of a New Orleans electric light company, who had lost his life through contact with a defective electric light wire, were denied damages. The court held in effect that the business of generating and supplying electricity for lighting and power involves operations that are highly dangerous to life, hence it becomes necessary for the employer in such case to instruct his employee in regard to the danger to which he is exposed. An employee having, in obedience to orders from his employer, encountered this hidden danger and thereby lost his life, is presumed to have trusted to the superior knowledge of his employer, and lost his life in the performance of an allotted duty of whose danger he was unaware. In the absence of proof that the employer had instructed and warned his servant in the premises, the former becomes liable for damages. The judgment which had been given to the Light and Power Company in the lower court was accordingly reversed and damages awarded the heirs.

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It is no longer a source of midnight sport—that is, the tracking and capture of the succulent opposum in the outskirts of Canton, Md. Not long since Canton determined to have arc lights, and the latter were soon in service. An unfortunate result, however, was that the opposums, attracted by the light, climbed the poles, completed the circuit, and were electrified. The Canton electricians ought not experience much difficulty in securing plenty of "colored" linemen.

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Governor Beaver, of Pennsylvania, has granted (after hearing remonstrances to such course submitted by the Altoona Gas Company) a charter to the incorporators of the Logan (Pa.) Gas and Water Company.

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The Common Council of Newark, N. J., has passed an ordinance regulating the height at which electric arc lamps are to be suspended in front of shop windows and doors.

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The New York and New Jersey Globe Gas Light Company has been awarded a contract for lighting the streets of North Plainfield, N. J., at its bid of $17 per lamp per annum.

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As indicative of the hold gas has on public favor in the East, we may note that about a fortnight ago an official of the Lewiston (Me.) Gas Light Company remarked: "We have gained over 20 per cent. in our output so far this year, and, best of all, the increase seems likely to continue to the end of the chapter. We gained 100 meters this year, which is a big gain in a city like ours." The Company, which has a large number of gas cooking stoves in service, will make a determined effort to popularize gas for heating.

---

A correspondent from Sacramento, Cal., says that differences have sprung up between the city and the Gas Company over the matter of street lighting. The Board of Trustees desired the Company (which owns the electric light plant also) to change the location of a number of masts, but as the city would not bear the expense incident to the change, the Company very properly refused. Mayor Gregory thereupon influenced the Trustees to appoint a committee charged with the task of determining what it would cost the city to purchase and operate a plant on municipal account.

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The capital stock of the Gas Consumers Benefit Company, of the United States, of which enterprise Walter M. Jackson is President, has been increased to $750,000 from $500,000.

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The following is a summary of the bids that were opened in Philadelphia, on the 16th inst., by Director Wagner, for supplying the named quantities of coal to the Trust gas works of that city for the ensuing year:

*Caking Coal.*

| Name of Bidder. | Quantity, tons. | Rate per ton. |
|---|---|---|
| Westmoreland Coal Company | 105,600 | $3.82 |
| Penn Gas Coal Company | 105,000 | 3.82 |
| Kanawha (C. & O. Railroad) | 25,000 | 3.80 |
| Manor Gas Coal Company | 10,000 | 3.81 |
| James Boice (Gaston coal) | 15,000 | 3.76 |
| Despard | 12,500 | 3.76 |
| Newburg Orrel | 12,500 | 3.76 |
| Montana Coal and Coke Company | 10,000 | 3.76 |

*Cannel Coal.*

| Name of Bidder. | Quantity, tons. | Rate per ton. |
|---|---|---|
| James & Wm. Wood (Shield's colliery) | 6,000 | $7.15 |
| Cannelton Company | 6,000 | 7.25 |
| J. J. Gordon (White Horse) | 6,000 | 7.24 |

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Mr. John C. Hunter, of Philadelphia, Pa., died at his home in that city on the 13th inst. Deceased was, according to local history, the man who laid the first gas main in the Quaker City. He was born in Phila-

delphia in 1809, and at an early age was apprenticed to Thos. Sparks, proprietor of a shot tower. In 1834 Hunter went to Petersburg, Va., and was there engaged in putting down the water mains of the Petersburg Aqueduct Company. That task completed he returned to his native city, to become a member of the plumbing firm of Wright and Hunter, in which undertaking he amassed a fortune.

JOHN J. MCCLELLAN, Master in Chancery in the case entitled D. C. Barry vs. Corsicana (Texas) Gas Light Company, is our authority for stating that all bonds and coupons in the Company that had not been examined by him for allowance on or before the 20th inst. shall have no standing in the final adjustment.

SUPT. J. W. WILCOX, of the Macon (Ga.) Gas Light and Water Company, has notified the residents that, because of a recent ordinance passed by the city, those who desire either gas or water services in the future must make written application for the same, in order that the city authorities shall, through the City Engineer, approve of the excavation sought to be made.

THE Boston *Post* seems to be an approved medium for offering to the public cat and dog ends of speculation. For instance, in a recent issue several lines (undoubtedly paid for at so much per line) were devoted to the shares in the stock of the Hydrocarbon Gas Light Company, which concern is said to possess a "valuable system of street lighting" which is guaranteed to give 50 per cent. more light than can be obtained from the ordinary gas lamp, and from 100 to 200 per cent. more light than is afforded by the ordinary kerosene or naphtha street lamp—all of which is secured at "but a slight additional cost." The capital stock of the concern is $225,000, divided into 75,000 shares, of a par value of $3 each, and these the Company offer now at $1.50 per share, "with right to advance price without notice." The object is "to secure additional working capital for development." We do not suppose that the Bay State Gas Company will subscribe to the "working capital for development," and we sincerely hope that this failure will be largely copied by all in Boston who have money to invest.

WE understand that Mr. V. L. Elbert, formerly in charge of the old Company's plant at Los Angeles, Cal., will, because of the consolidation of the conflicting gas interests at that point, soon be again with us in this part of the Union.

AT a conference of the Catholic priests of the Archdiocese of New York, held in this city on the 17th inst., and presided over by Archbishop Corrigan, it was determined that no electric lights should be used in the Catholic churches until the question of the safety of such illuminating methods had been positively demonstrated.

THE proprietors of the Ironton (Ohio) Gas Company have issued a circular announcing that on and after Jan. 1st the following schedule of gas rates shall go into effect:

| Quantities, Monthly. | Gross rate per M. |
|---|---|
| For first 1,000 cubic feet, or less..... | $1.60 |
| For next 2,000 " " (1,100 to 3,000)..... | 1.50 |
| For next 7,000 " " (3,100 to 10,000).... | 1.40 |
| For all over 10,000 cubic feet..... | 1.30 |

The rate for gas consumed in cooking and heating stoves and for power purposes is rated at (gross) $1.40, with 5 per cent. off for prompt payment. It is further provided, however, that 1,000 cubic feet must be used each month before the heating and power rate becomes operative. The gross rate for illumination purposes is further reduced by the operation of a 5 per cent. discount allowed on all bills paid on or before the 10th day of the month in which they are rendered. This is cheap gas, certainly; and the best feature of the Ironton situation is that this is the second reduction that has been made by the Company this year. The initial concession was granted on April 1st, and we submit that action like this is the best evidence that can be presented of the advances that are being continuously made in the cheapening of the process of gas manufacture. The present concession is equivalent to an all-round reduction of 20 cents per 1,000 cubic feet. We congratulate the Company and its efficient Manager, Mr. W. W. Prichard, on the satisfactory progress that is being made in gas supply at Ironton.

IN connection with the above we may say that a correspondent who has recently completed a somewhat prolonged journey in the Central West, in speaking of gas matters at Ironton, says: "The Ironton Company has had no street lamps since May, and yet the Company is selling more gas than was the case a year ago. I do not know whether or not I am violating a confidence, but I feel I must say that in November, 1889, the Company sent out 85,000 cubic feet more gas than for the corresponding month of 1888, and the percentage of unaccounted-for gas also shows a most satisfactory reduction. The Fort Wayne Jenney Electric Light Company's managers are now attempting to induce the city to install a municipal plant, which to say the least seems rather queer, since, according to the original programme of some months ago, this Company was to install, by September 1st, a plant on its own account. Its organizers now say that they will begin 'next week.' Next week is rather indefinite, but there does not appear to be any likelihood that that time will ever come for the Jenney folks at Ironton." The city is growing rapidly, and holds within it many well managed business enterprises, and I do not believe that I am wide of the mark when I say that the Ironton Gas Company is as forward as any of them.—B."

MR. C. W. KOHLSAAT, of this city, informs us that the minority shareholders in the San Diego (Cal.) Gas and Electric Light Company have determined to join hands with the majority in the scheme for reorganization planned by Mr. Fanshawe and his confreres. Since the former are to obtain every advantage that shall accrue to the latter under the method proposed, we incline to the view that Mr. Kohlsaat and his clients have acted with wisdom. In any event, San Diego's illuminating interests are sure to be advanced. The plant, which has been greatly improved of late, will soon be materially increased.

THESE are piping times for the Gas Companies of New York city. In fact the demand on their capacity threatens their resources.

## Spiral Weld Steel Tubing.

At a meeting of the Engineers' Club, Philadelphia, Mr. George Burnham, Jr., described to the members the process pursued in the manufacture of spirally welded steel tubing at the Orange (N. J.) factories. Mr. Burnham exhibited a length of pipe 10 inches in diameter by 9 feet 5 inches long, and explained its construction as follows:

A ribbon of skelp of the desired width and length is fed to a guide-table at the proper angle with the axis of the pipe machine. This machine, operated by a belt from a countershaft, automatically winds the skelp into a spiral tube. The incoming edge of the skelp passes through a small furnace about a foot square, enclosing a blow-pipe flame of water gas and air which heats both edges of the pipe to a welding heat. A small hammer, with a rapid action, welds the overlapping edges as the pipe feeds forward. The pipe is stiff and light, and is said to be very strong, the usual gauges of stock used being from 16 to 14 B.W.G., for pipes from 6" to 24" diameter. It is used for conveying gas, water, steam, etc., at the usual pressures required.

There was considerable discussion of this contribution, and of other matters of interest connected with pipes and joints.

## Water Power for Electric Lighting.

The *Engineering Record* calls attention to the fact that the utilizing of water power for electrical purposes is being vigorously taken in hand in Europe. The foreign exchanges have for some time past given the subject considerable attention and recorded the installing of a large number of such plants.

Among the more recent ones, referred to in the *Zeitschrift fur Electrotechnik*, is the electric lighting plant at Gastein, in Austria, the power there being supplied by the river Ache. The available head of water is 21 meters, or about 69 feet, giving, with the quantity of water at disposal, a 154 theoretical horse power. Allowing for a loss of 20 per cent. in the turbine, the net power figures up about 123-horse power. The water is led to the wheel through a 28-inch pipe about 230 feet long, and before being again returned to the river, drives, moreover, two small mills, and a small pumping plant in connection with the hot springs at that place. A Girard turbine, making 140 revolutions per minute, is used. There are, in all, four dynamos, one of them held in reserve for emergencies. The plant is designed to supply 1,000 incandescent lamps of 16-candle power each.

Another recent application of water power is found at St. Hillaire de Harcouet, France. The electric lighting station for this town is located on the banks of the small river Le Vauroux, about 2½ miles distant. The water is stored up in three reservoirs, about three hours being necessary to fill them. The supply thus obtained is sufficient to work two water wheels, successively, for 8 hours. The wheels are 16½ feet in diameter, and, at a speed of 7 revolutions per minute, develop 10-horse power each. Eighty incandescent lamps are supplied. Preparations are also in progress to light the town of Trient, Austria, by means of water power. The lighting station at Innsbruck, Austria, takes power from a small river about two miles away, the river being dammed to get a head of water of about 377 feet. The available power amounts to over 600-horse power. Only two turbines of 150-horse power each are at present employed.

In Switzerland the project of utilizing the power of the river Lorze is under consideration. About 1,300-horse power is available, and is to be distributed electrically to the various working points. The cost of the necessary station and general outfit is estimated at about $300,000.

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MONDAY, DECEMBER 23, 1889.

## Condensation in Steam Cylinders.

BY B. DONKIN, JR., C. E.

In his paper on this subject (read before the English Institution of Civil Engineers) Mr. Donkin described a form of glass apparatus for rendering visible the effects of condensation and evaporation that take place inside a steam engine cylinder. We herewith reproduce an abstract of his remarks :

This apparatus is a kind of transparent prolongation of the cylinder walls; it can be varied in construction, and fixed to different types of steam engines, working under different conditions. Mr. Hirn, having seen it at work at Colmar, wished some members of the Mulhausen Society to have the opportunity of studying it in action, and hence this note.

The apparatus consists of two vertical glass cylinders, of different diameters, but of equal length, placed concentrically one within the other between two horizontal metal plates, air being allowed to remain between the glasses, It is connected with the cylinder by means of the pipe and cock generally used for the steam engine indicator.

When this cock is opened the inside of the inner glass becomes, so to speak, a part of the cylinder, subject to almost the same conditions, as the air between the glass cylinders prevents external cooling in the same way as ordinary lagging. The cock being open, and the apparatus having acquired its normal temperature, interesting phenomena can be observed, through the glasses, at each stroke while the engine is going. A revolution on one side of the piston, where there is no expansion, may be divided into: (1) The steam stroke; (2) the exhaust stroke. During the first period, immediate condensation of the steam takes place, the inner surface of the glass cylinder being covered with drops and dew. During the return or exhaust stroke, the direction of the piston having changed, the dew, &c., rapidly evaporates and disappears entirely before the end of exhaust, the glass becoming quite clear. By fixing the apparatus to condensing or non-condensing steam engines, with and without jackets, and with and without expansion, the phenomena corresponding to those conditions can be observed. There is much more condensation on the inside of the glass when the apparatus consists of a single glass cylinder. If two glasses are used, and arranged so as to admit steam of sufficient pressure between them (steam jacketted), no condensation is visible.

The apparatus can be used for either vertical or horizontal engines. If it is screwed on to the lowest part of an engine, so as to drain the cylinder, it will show whether water accumulates or evaporates, with or without steam in the jacket, and with condensing or non-condensing engines. So rapid are the phenomena of condensation and evaporation, that there is no perceptible difference for speeds from 30 to 150 revolutions per minute.

A sketch of the apparatus is added to the original note.

Since the above was communicated through Mr. Hirn to the Mulhausen Industrial Society, the apparatus, which had been named the "Revealer" by Mr. Hirn, has been modified so that the quantities of heat given to its metal walls can be measured.

The vertical glass cylinder in the interior of the apparatus is replaced by a small hollow vertical cast-iron cylinder. The annular space between the outside of the iron cylinder, and the outer glass cylinder, is put in communication with the steam engine.

In the inside of the iron cylinder, steam, oil, glycerine, or water is made to pass, and the walls thus kept at will at different temperatures. These temperatures are taken by a special arrangement with a mercurial thermometer, and at different depths in the cast-iron walls, if required. The quantities of head required to keep the walls at any series of temperature, by means of steam, water, &c., can be measured and plotted, or, in other words, the number of thermal units gained or lost by the walls and the water of the apparatus, when kept at a given temperature, ascertained and worked out in thermal units per square foot per minute. This is for the combined effect, viz.: (1) Steam stroke; (2) exhaust stroke.

The quantities of heat have also been meas used separately for each of these two heat periods, by leaving the apparatus open to the engine cylinder only during a series of steam strokes, and shut during all the exhaust strokes. Thus it can be kept open for any length of time to all steam strokes only, or to all exhaust strokes only, and the cooling of the little walls exposed only to the condenser measured in thermal units. The experiments give considerable cooling to the condenser for combined, as well as for exhaust strokes alone.

The effects of condensation and re-evaporation for combined strokes are clearly visible on the metal walls of the apparatus for different temperatures of the latter. When the walls are relatively cold, the drops are larger, and evaporation from them slower; when hotter, they are smaller and evaporation quicker. When the walls are hotter than the initial temperature of the entering steam, no mist or dew is visible.

Supposing the case of the walls of an actual steam engine cylinder, having a certain temperature in a hole, say, 1 millimetre from its inner cast-iron walls. The apparatus attached to it, also provided with cast-iron walls, can be kept at this same temperature (taken in the same way and at the same depth), and the number of thermal units per minute per square foot necessary to obtain this result can be ascertained. In some cases, heat is put into the walls and water, in others it is taken from them, depending on the temperature the walls are kept.

The iron walls of the apparatus can be steam-jacketted or not, at will, like a steam cylinder.

## The Velocity of the Wind at the Top of the Eiffel Tower.

In June of the present year a series of observations on the velocity of the wind at the top of the Eiffel Tower were commenced. For this purpose there was erected on the tower, at a heighth of 995 ft. above the ground, an autographic anemometer, constructed by Messrs. Richard Brothers, of Paris, another of these instruments being at the same time put up at a station situated at 1650 ft. from the foot of the tower, the height in this case being about 69 ft. above the ground. Up to the 1st of October last complete observations had been obtained for 101 days, and from these it appears that on an average the velocity of the wind is about 3.1 times as great at the more lofty station than it is at the lower. Moreover, the breeze at the top is always fairly strong, as during the whole of the summer months in which observations were taken, the average velocity of the breeze throughout any given day always exceeded 23 ft. per second, and during 21 per cent. of the whole period of the observations this average daily velocity was upwards of 33 ft. per second. No great storm seems to have occurred during the time over which the observations extend, and we do not know the maximum wind velocity registered during this time.

## Gas Stocks.

**Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.**

16 WALL ST., NEW YORK CITY.

DECEMBER 23.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

| | Capital. | Par. | Bid | Asked |
|---|---|---|---|---|
| Consolidated | $35,430,000 | 100 | 94¼ | — |
| Central | 500,000 | 50 | — | — |
| " Scrip | 220,000 | — | — | — |
| Equitable | 4,000,000 | 100 | 122 | 127 |
| " Bonds | 1,000,000 | — | 113 | 115 |
| Harlem, Bonds | 170,000 | — | — | — |
| Metropolitan, Bonds | 658,000 | — | 116 | 118 |
| Mutual | 3,500,000 | 100 | 103 | 105 |
| " Bonds | 1,500,000 | — | 100 | 102 |
| Municipal, Bonds | 750,000 | | — | — |
| Northern | ..... | 50 | — | — |
| " Bonds | 150,000 | — | — | 100 |
| Standard Gas Co — | | | | |
| Common Stock | 5,000,000 | 100 | -- | -- |
| Preferred | 5,000,000 | 100 | — | — |
| Yonkers | | 50 | 112 | — |
| Richmond Co., S. I. | 346,000 | 50 | 60 | 70 |
| " Bonds | 20,000 | — | — | — |
| Gas Co's of Brooklyn. | | | | |
| Brooklyn | 2,000,000 | 25 | 109 | 110 |
| Citizens | 1,200,000 | 20 | 68 | 70 |
| " S. F. Bonds | 320,000 | 1000 | 100 | 103 |
| Fulton Municipal | 3,000,000 | 100 | 122 | 125 |
| " Bonds | 300,000 | | 100 | 105 |

| | | | | |
|---|---|---|---|---|
| Peoples | 1,000,000 | 10 | 75 | 77 |
| " Bonds (5's) | 368,000 | — | 100 | — |
| " " (6's) | 94,000 | — | 100 | — |
| Metropolitan | 1,000,000 | 100 | 95 | — |
| Nassau | 1,000,000 | 25 | 112 | — |
| " Ctfs | 700,000 | 1000 | 100 | — |
| Williamsburgh | 1,000,000 | 50 | 118 | 122 |
| " Bonds | 1,000,000 | — | 108 | 112 |
| **Out of Town Gas Companies.** | | | | |
| Boston United Gas Co.— | | | | |
| 1st Series S.F. Trust | 7,000,000 | 1000 | — | 93 |
| 2d " " | 3,000,000 | 1000 | 71 | 72 |
| Bay State Gas Co.— | | | | |
| Stock | 5,000,000 | 50 | 21½ | 23 |
| Income Bonds | 2,000,000 | 1000 | — | — |
| Buffalo Mutual, N. Y. | 750,000 | 100 | 90 | 95 |
| " Bonds | 200,000 | 1000 | 95 | 100 |
| Citizens, Newark | 1,000,000 | 50 | 155 | 160 |
| " " Bonds. | 45,000 | — | — | — |
| Chicago Gas Trust | 25,000,000 | 100 | 43 | 43¼ |
| Chicago Gas Light. & Coke Co.— | | | | |
| G't'd Gold Bonds | 7,650,000 | 1000 | 93 | 94 |
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,000,000 | 1000 | — | 101 |
| People's Gas and Coke Co., Chicago— | | | | |
| 1st Mortgage | 2,100,000 | 1000 | — | 99 |
| 2d " | 2,500,000 | 1000 | — | 98¼ |
| Consumers Gas Light Co., Jersey City | 2,000,000 | 100 | — | — |
| Bonds | 600,000 | 1000 | — | — |
| Cincinnati G. & C. Co. | 6,000,000 | 100 | 214 | 218 |
| Consumers Toronto | 1,000,000 | 50 | 190 | 200 |
| Central, S. F., Cal | | | 80 | 90 |
| Capital, Sacramento, Cal | | | 58 | |
| Consolidated, Balt | 11,000,000 | 100 | 43¼ | 43½ |
| " Bonds | 6,400,000 | | 107 | 107½ |
| Hartford, Conn | 750,000 | 25 | 102 | 108 |
| Jersey City | 750,000 | 20 | 190 | — |
| Laclede Gas Light Co., St. Louis, Mo.— | | | | |
| Common Stock | 7,500,000 | 100 | 19 | 21 |
| Preferred " | 2,500,000 | 100 | — | — |
| Bonds | 9,034,400 | 1000 | 87½ | 89¼ |
| Louisville, Ky | 2,570,000 | 50 | 125 | 130 |
| Little Falls, N. Y. | 50,000 | 100 | — | 100 |
| " Bonds | 25,000 | — | 100 | 103 |
| Montreal, Canada | 2,000,000 | 100 | 200 | 208 |
| Memphis (Tenn.) Gas | 750,000 | 100 | 48 | 51 |
| " Bonds. | 240,000 | 100 | 103 | — |
| New Haven, Conn | | 25 | 200 | — |
| Oakland, Cal | | | 35 | 35½ |
| Peoples, Jersey City | | — | 60 | 61 |
| " " Bonds | | | — | — |
| Paterson, N. J | | 25 | 99 | 102 |
| Rochester, N. Y | | 50 | 99 | 100 |
| Syracuse, N. Y | 500,000 | 25 | — | — |
| San Francisco Gas Co. | | | 60 | 60½ |
| San Francisco, Cal | 10,000,000 | 100 | 59¾ | 60 |
| Washington, D. C | 2,000,000 | 20 | 200 | 208 |
| Wilmington, Del | | 50 | 200 | 208 |

# Advertisers Index.


**GAS ENGINEERS.** Page

Jos. R. Thomas, New York City ... 912
Wm. Henry White, New York City ... 901
Wm. Mooney, New York City ... 912
William Gardner, Pittsburgh, Pa ... 912
Fred. Bredel, N. Y. City ... 911

**GAS AND WATER PIPES.**

Gloucester Iron Works, Phila., Pa ... 912
Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 912
Ohio Pipe Co., Columbus, Ohio ... 912
M. J. Drummond, New York City ... 912
R. D. Wood & Co., Phila., Pa ... 914
Warren Foundry & Machine Co., New York City ... 912
Donaldson Iron Co., Emaus, Pa ... 912
Dennis Long & Company, Louisville, Ky ... 912
A. & W. S. Carr Co., New York City ... 864

**GAS WORKS APPARATUS AND CONSTRUCTION.**

James R. Floyd & Sons, New York City ... 915
Continental Iron Works, Greenpoint, L. I ... 915
Deily & Fowler, Phila., Pa ... 915
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 903
Stacey Mfg. Co., Cincinnati, Ohio ... 915
Bartlett, Hayward & Co., Baltimore, Md ... 913
Morris, Tasker & Co., Limited, Phila., Pa ... 913
Davis & Farnum Mfg. Co., Waltham, Mass ... 903
R. D. Wood & Co., Phila., Pa ... 914
Bouton Foundry Co., Chicago, Ills ... 915
Smith & Sayre Manufacturing Co., New York City ... 915
Fred. Bredel, N. Y. City ... 911
United Gas Improvement Co., Phila., Pa ... 905
Henry Pratt & Co., Chicago, Ill ... 914
National Gas Light and Fuel Co., Chicago, Ills ... 906
Simpkin & Hillyer, Richmond, Va ... 900

**PROCESSES.**

National Gas Light and Fuel Co., Chicago, Ills ... 906
Bartlett, Hayward & Co., Baltimore, Md ... 913
Wm. Henry White, N. Y. City ... 901
United Gas Improvement Co., Phila., Pa ... 905
Henry Pratt & Co., Chicago, Ill ... 914

**INCLINED RETORTS.**

Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 867

**GASHOLDER TANKS.**

W. C. Whyte, New York City ... 906
J. P. Whittier, Brooklyn, N. Y ... 901

**GASHOLDER PAINT.**

The Government Waterproof Paint Co., Boston, Mass ... 900

**RETORTS AND FIREBRICK.**

J. H. Gautier & Co., Jersey City, N. J ... 910
B. Kreischer & Sons, New York City ... 910
Adam Weber, New York City ... 910
Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 910
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 910
Borgner & O'Brien, Phila., Pa ... 910
James Gardner, Jr., Pittsburgh, Pa ... 910
Henry Maurer & Son, New York city ... 911
Chicago Retort and Fire Brick Co., Chicago, Ills ... 910
Baltimore Retort and Fire Brick Co., Baltimore ... 910
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo ... 910

**SCRUBBERS AND CONDENSERS.**

G. Shepard Page, New York City ... 868
R. D. Wood & Co., Phila., Pa ... 914

**REGENERATIVE FURNACES.**

Bartlett, Hayward & Co., Baltimore, Md ... 913
Fred. Bredel, New York City ... 911
Chicago Retort and Firebrick Co., Chicago, Ills ... 910
Wm. Henry White, N. Y. City ... 901
J. H. Gautier & Co., Jersey City, N. J ... 911

**GAS GOVERNORS.**

Connelly & Co., New York City ... 907
Fred. Bredel, N. Y. City ... 911
Friedrich Lux, London, England ... 900

**SELF-SEALING MOUTHPIECE DOORS.**

Smith & Sayre Mfg. Co., New York City ... 911

**TAR AND CARBONIC ACID EXTRACTOR.**

Geo. Shepard Page, N. Y. City ... 904

**PURIFYING MACHINES.**

C. & W. Walker, London, England ... 866

**CEMENTS.**

C. L. Gerould & Co., Brooklyn, N. Y ... 910

**GAS ENRICHERS.**

Standard Oil Co., Cleveland, Ohio ... 916

**GAS METERS.**

Harris, Griffin & Co., Phila., Pa ... 918
American Meter Co., New York and Philadelphia ... 919
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 919
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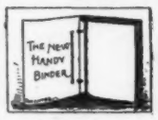


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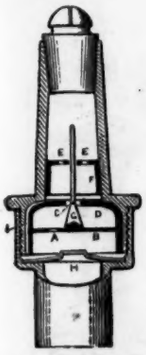

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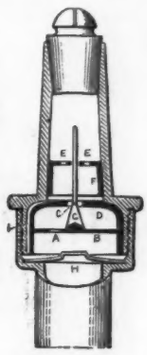

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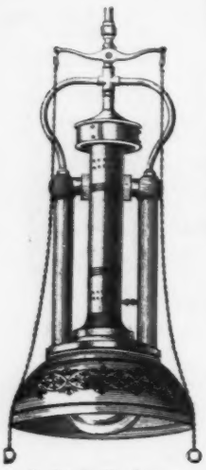

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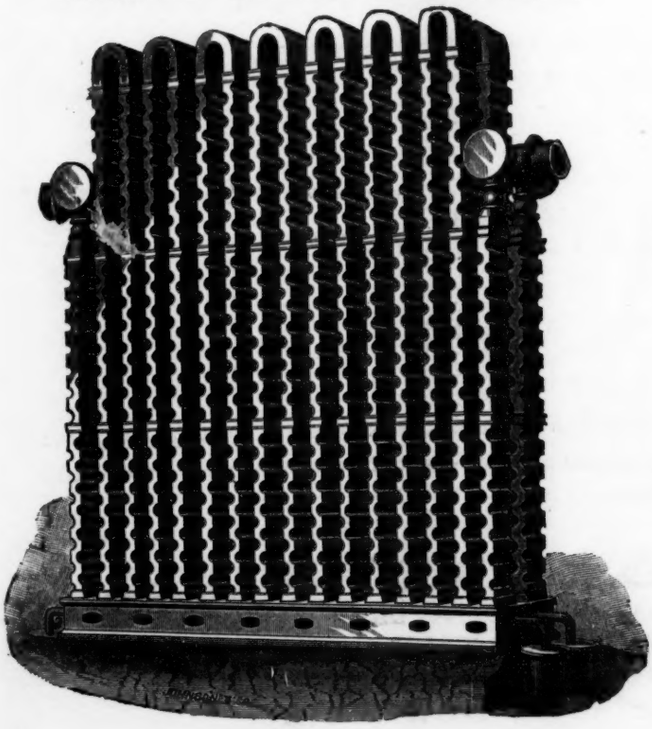

We desire to draw the attention of the gas community to the merits of the SINUOUS FRICTION CONDENSER. Companies intending to introduce new condensers into their works will do well to confer with us and examine plans and estimates before contracting for any other pattern The FRICTION CONDENSER is now in use at the gas works located in the following places:

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The following Engineers have personally given permission to refer to them:

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Mr. Charles A. Gerdenier, Superintendent of the Bridgeport (Conn.) Gas Light Company, writes as follows, under date of Dec. 3, 1887:

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| No. 7, | " | " | 1,250,000 | " | " | " | 9 | " | " | " | " |
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| No. 9, | " | " | 2,000,000 | " | " | " | 12 | " | " | " | " |
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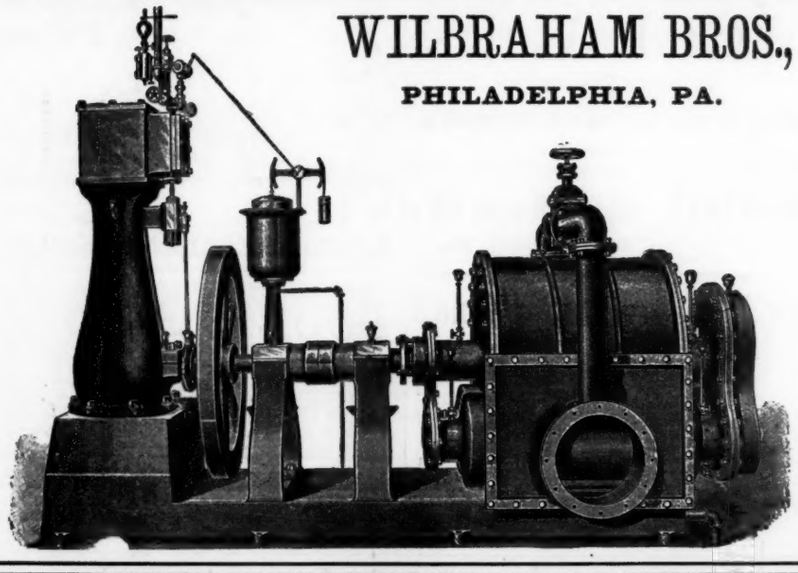

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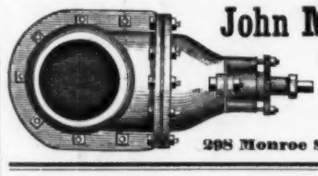

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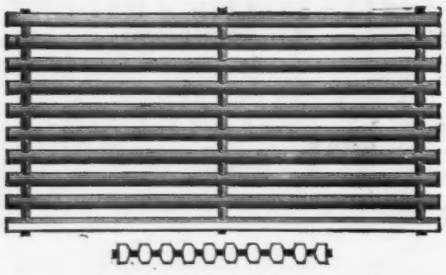

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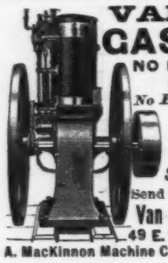

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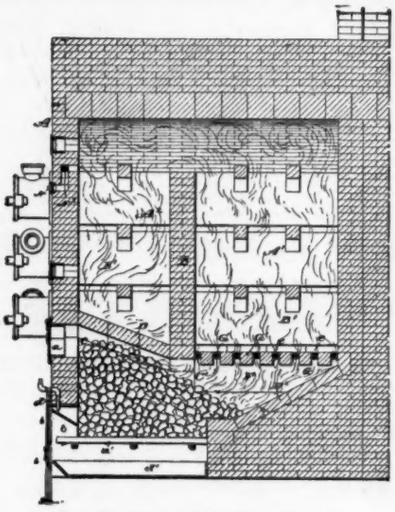

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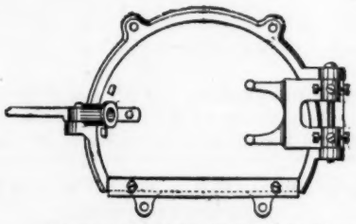

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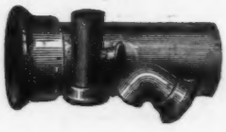

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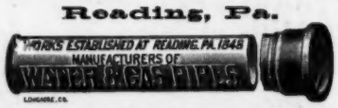


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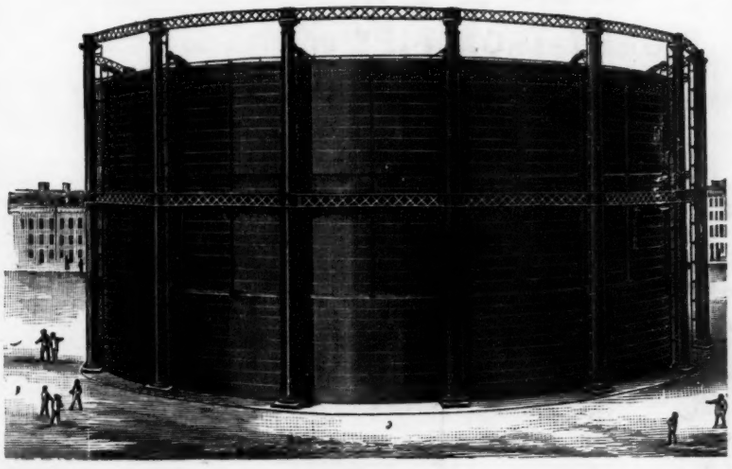

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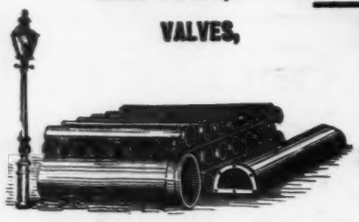

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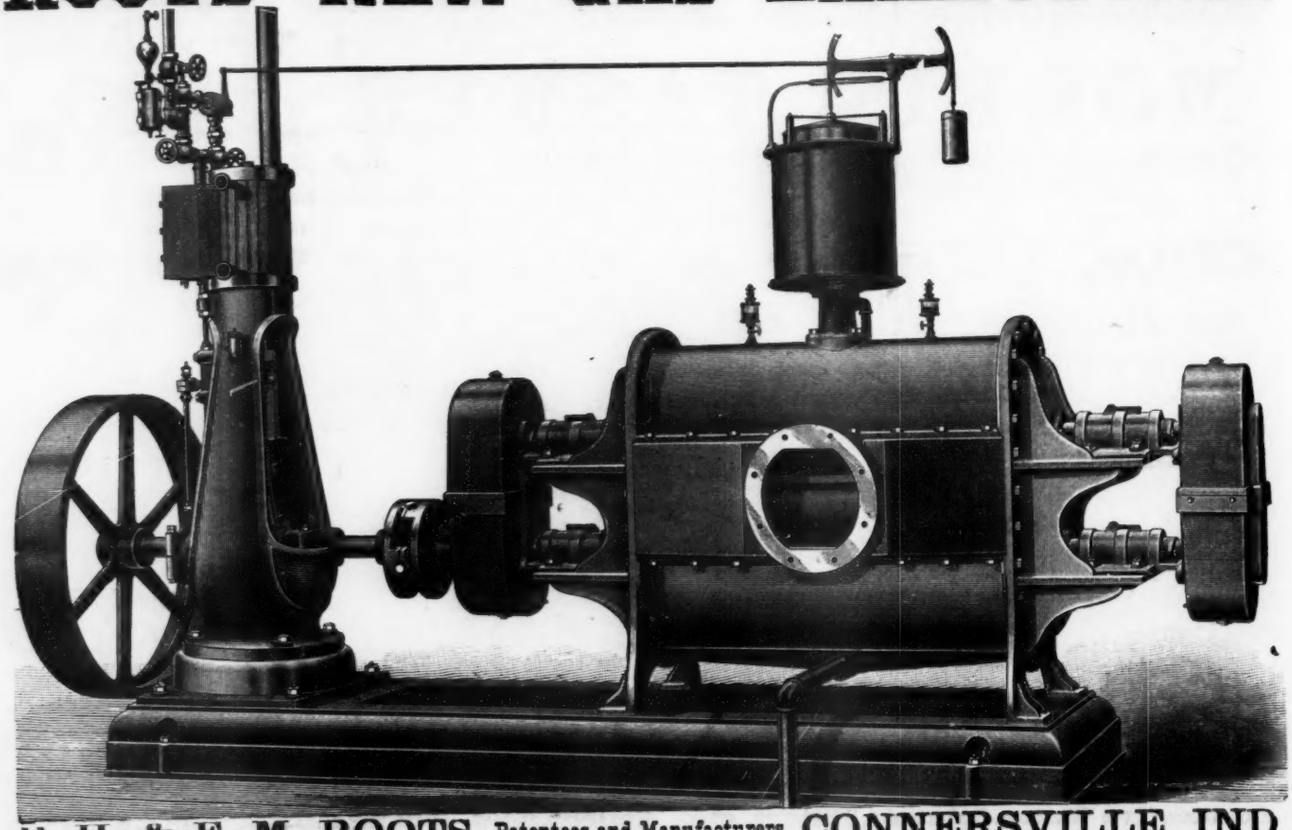

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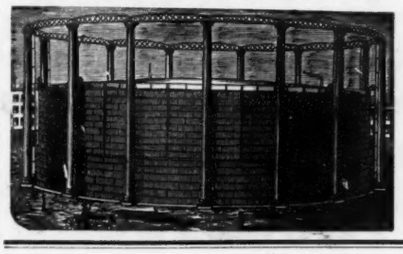
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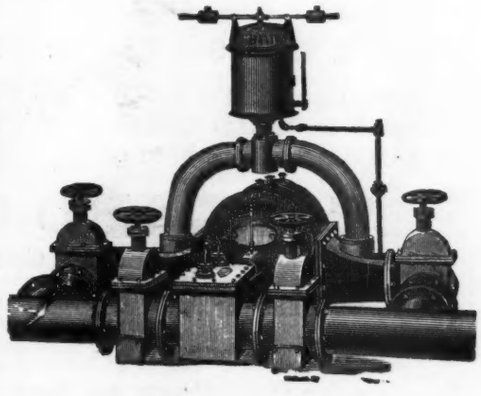

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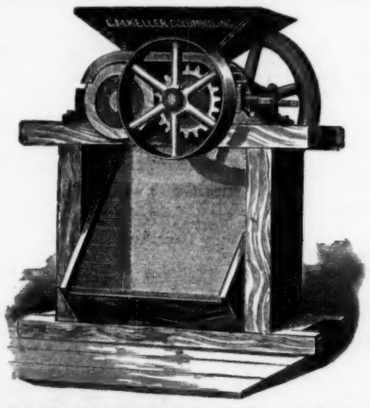

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| | 12 in. deep. | 13 in. deep. | | |

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